The employment dimension of construction: A closed input-output analysis

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Abstract

Construction is crucial for economic and employment growth. Output and employment multiplier effects between 1995 and 2009 were analysed using closed input-output models based on the World Input-Output Database and the EORA multi-region input-output database. Main findings are: 1.total output multipliers in construction are higher than economy but total employment multipliers in construction lack of simple patterns, they are usually uppermost just in higher income countries; 2.decreasing trends of total employment and output, to a lesser extent, multiplier effects at overall level and in construction; 3.direct and indirect effects remain steady, but induced effects have accounted for most of the changes of total effects; 4.mostly, cross-time changes in domestic positions of output and employment multipliers of construction were in the same direction; 5.deflators of the real labour cost per unit of output in foreign currency become key variables to explain performances of ratios of employment to output multipliers.

Resumen

La construcción es fundamental para el crecimiento económico y el empleo. Con un modelo insumo-producto cerrado a partir de la World Input-Output Database y la base insumo-producto multiregional EORA, se analizan los efectos multiplicadores de producto y empleo entre 1995 y 2009. Principales hallazgos son: 1.la construcción tiene multiplicadores totales de producto superiores al promedio de cada economía, pero la relación con los multiplicadores totales de empleo es variante, por lo general sólo son más altos en los países de mayores ingresos; 2.hay tendencias declinantes de los multiplicadores del producto (en menor grado) y del empleo a nivel global y en la construcción; 3.los efectos directos e indirectos se mantienen estables, pero los efectos inducidos han representado la mayor parte de los cambios de efectos totales; 4.en la mayoría de los países, cambios punta a punta en el ranking doméstico de multiplicadores de producción y empleo de la construcción fueron en la misma dirección; 5.los deflactores del costo laboral real por unidad de producto en moneda extranjera son variables clave para explicar las actuaciones de las relaciones de empleo a los multiplicadores de salida.

Keywords: Input-output analysis, Employment multiplier effects, Construction
Palabras clave: Análisis insumo-producto, Multiplicadores de empleo, Construcción
Clasificación JEL: C67, L74, Q52

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I. Introduction

Over the past three decades, the ILO Employment Intensive Investment Programme (EIIP) has evolved considerably from a series of relatively stand-alone labour intensive programmes -with positive but limited impacts on employment and living conditions in target populations- to more systemic interventions which, based on earlier pilot experiences, contribute to job creation and infrastructure deficits on a larger and more systematic scale. As the EIIP evolved, with a growing number of projects completed and the evidence base increasing, the ILO focused its analytical and operational work on both the quantitative and qualitative dimensions of decent work. Such research includes feasibility and baselines studies, project evaluations and impact assessments.

In November 2005, the ILO Governing Body called on the Office to develop this kind of employment impact assessment (EmpIA): "methodologies and approaches, such as impact assessments for integrated environmental and employment outcomes of investment plans and programmes."[1] In November 2006, the Governing Body furthermore endorsed the ILO's work on EIIP as a strategic priority: "promoting systematic employment impact assessment of public and private investment programmes and policies to enhance EIIP's selectivity and support to the development of strategic project streams."[2] Since input-output (I-O) and social accounting matrix (SAM) models are able to combine potential job creation to productive structure in backwards and forward linkages, they have shown to be appropriate to cover these demands.

In this regard, a starting point for all EmpIA methodologies is the acceptance of "employment multipliers" as indicators and ensuring that the required data are available at national, sectoral and regional levels. Moreover, models should look at direct and indirect employment effects as well as induced employment, which increases the income flow back into the economy through higher consumption leading to a rise in production and tax collection. They are expected to look at economic and social (even environmental) issues and goals in an integrated way.

The financial crisis that swept the globe beginning in 2007, and the subsequent stimulus packages that were put in place in many countries, put popular pressure on governments to prove that their employment objectives were being met. A recent ILO study Ghose, Majid and Ernst, 2008 concluded that growth in gross domestic product (GDP) did not always have the expected positive impact on employment, which led to a rise in

1 GB.294/ESP/2, November 2005.

2 GB. 297/PFA/2/2, November 2007.

global unemployment. It is, therefore, crucial to understand which sectors would have an increase in employment, and how backwards and forward linkages, technology choices or induced/income effects impact on employment. In order to do that, we focus on the construction sector, particularly public infrastructure, which is a key sector for each economy not only in terms of growth and development, but also employment. However, lack of adequate infrastructure or facilities might be a sign of different development stages among countries; even though the construction sector is often known for its high integration with the rest of the economy in comparison to service sectors or specific manufacturing sectors. Therefore, this study focuses on the construction sector, comparing and analysing its employment dimension in relation to the overall economy across time and among countries.

II. Methodological considerations

Any I-O or SAM multiplier analysis starts by recognizing the importance of productive interdependences within an economy. In other words, this analysis takes place in a circular-flow framework where production, demand, distribution and, sometimes, wealth disposal are interlinked. The main goal is to build an I-O model based on a detailed accounting of inter-industry activity in a given economy in order to obtain multiplier effects, forward and backward, mainly within the production system during a certain period, generally a year. By focusing on production linkages between commodities and activities as well as their potential impacts on employment and income distribution, the I-O model is a helpful tool for economic analysis in order to identify bottlenecks, trade-offs and complementarities, set up production priorities and calculate cost-benefit effects or price-cost margins. It can help in the identification of i) sectors and commodities that create the highest production or value added and their import requirements; and ii) the highest employment or income effect (including distributional effects), in response to changes in exogenous sectoral final demand, caused by public policies, private sector development or external shocks (*e.g.* financial crises or natural disasters).

Since every model is a simplified representation of reality, it is necessary to be aware that the coexistence of different technologies in the production of relatively homogeneous commodities is usually omitted in the I-O models. This often happens to different market segments buying physically similar products at different prices or having wide degrees of import dependence (Alarcón, 1991).[3]

[3] Three main assumptions underlay the implementation of I-O/SAM type models: i) there is excess capacity in all the sectors as well as unemployed or underemployed productive factors in order to avoid over-estimations facing positive shocks; ii) structural linkages remain the same; and iii) there are limited endogenous responses implying that at least one account must be identified as exogenous (Round , 2003).

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Notwithstanding, the assumptions of the I-O model, fixing proportional relationships between inputs and measuring commodities at constant prices are very limited and render the model static. Firstly, under the proportionality assumption, domestic inputs and foreign inputs (*i.e.* imports) are complementary. However, in practice, substitution between domestic inputs and imports is almost always possible, except for typical non-tradable goods (*e.g.* the output of construction activities and government activities), and for really complementary imports such as oil in countries that do not have oil resources.[4] Secondly, relationships between inputs and outputs can be assumed fixed only in the short and medium terms.[5]

A third limitation is the assumption about constant relative prices since the I-O model only allows the evaluation of cost push inflation and it is impossible to analyse the impact of relative price changes on the economy (Alarcón, 1980; Bulmer-Thomas, 1982). Fourthly, the constant market shares hypothesis implies that regardless of technological changes, the product mix -within a broad sector of production activities- is thought to remain stable over a given period. A fifth limitation relates to the instantaneous adjustments that are supposed to take place in the models, when in practice, production reacts with some delay to changes in demand.[6] Finally, and most importantly, when domestic production goes up in reaction to exogenous increases in final demand, the basic (open) I-O model does not account for feedback of income changes into final consumption (Alarcón, 2006).

In spite of working with I-O analysis, these main assumptions can be put aside in this study due to the fact that our main purpose is to provide a wide picture of main trends and dynamics of the construction sector around the world instead of calculating forecasts and projections. In other words, an I-O analysis ex-post leaves out some of the previous assumptions. Since the World Input-Output Database (WIOD) supplies over time nominal variables, it captures prices and quantities for a 15-year-period, allowing analysing changes in relative prices from one year to another. Additionally, nowadays models and estimations appear to be more accurate to catch marginal technological changes and production reactions when data are

4 Note that there are at least two other ways of treating imports, namely, all competitive or some competitive and some complementary (see Dervis, de Melo & Robinson, 1982:24–29).

5 It is not surprising then, that a great deal of research that has been devoted to ex¬plaining the instability of the coefficients and to measuring their movements (see Alarcón & Vos, 1989 and Otto & Johnson, 1993, chapters 15 and 16).

6 This is a main characteristic in general equilibrium models, for I-O models it can be lifted by introducing a dynamic relationship such as the accelerator function (Alarcón, 1980).

available. Lastly, pursuant to open I-O model constraints, this paper presents a methodological and analytical development based on the closed I-O model.

A. The model

The I-O table is the key element in this kind of model due to the fact that it typifies and quantifies all the intersectoral transactions. Column entries represent sectoral expenditures on intermediate or material input and factor input payments (sectoral value added), while row entries show intermediate and final commodity demand by sector of origin. I-O tables record sales by one producing sector to another and to final users, measured at current prices (Chenery & Watanabe, 1958). The magnitudes of these flows depend on the total amount and pattern of domestic demand, the composition of imports and exports, physical I-O proportions and relative prices. As for the SAM, the I-O table also provides a coherent accounting framework that allows indicators of growth, production and income distribution to be combined, and several data sources to be reconciled and consolidated into an integrated database for economy-wide, policy-oriented models (van Heemst, 1991).

In this regard, the first step to I-O-based multiplier models is to get the coefficient matrix A identifying all intersectoral demands as endogenous variables. By focusing on the backward linkages, each industry record (cell) is divided by its respective gross output (column total) in order to obtain the direct requirements for each industry at domestic level. All of them conform to matrix A or the technical coefficient matrix, which shows the share of production of each sector that depends on the rest of the domestic activities. In matrix terms, the open I-O model is as follows:

1. $Y = X + AY$
2. $(I - A) * Y = X$
3. $\Delta Y = (I - A)^{-1} * \Delta X$
4. $\Delta Emp = \frac{E}{O} * \Delta Y$

Where:

$Y =$ total demand vector = gross output vector
$X =$ final demand vector
$A =$ technical coefficient matrix, non-negative with $a_{ij} \geq 0$ for all i and j

$a_{ij} = \frac{x_{ij}}{X_i}$ where x_{ij} is the j^{th} intersectoral requirement of the i^{th} commodity and X_j is the j^{th} sectoral output

$I =$ identity matrix
$(I-A)^{-1} =$ Leontief inverse matrix
$Emp =$ employment multiplier effects matrix

$\frac{E}{O} =$ diagonal matrix of sectoral employment output ratios with $e_j = e_{ij}$ if $i = j$

$e_{ij} = e_j = \frac{employment_j}{output_j} =$ employment output ratio where $j = 1 \ldots n$

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Later on, the multiplier or Leontief inverse matrix $(I - A)^{-1}$ is obtained which measures unitary injection impacts at inter-industry level. In this regard, the Leontief inverse matrix accounts for how the production of the i^{th} commodity changes when the demand of the jt^{h} industry has changed. In other words, the sum of each column represents the backward productive linkages, where each element is a multiplier of one additional monetary unit spent in a certain sector on the total output at overall level - these are also known as type I multipliers. To split different multiplier effects, indirect effects are obtained by subtracting the direct coefficient a_{ij} from the total productive requirements l_{ij} (Table 1). In order to capture the direct impact of that additional monetary unit on employment, an employment satellite account has to be built in order to derive the employment multipliers (matrix Emp). This is the sum of products between each technical coefficient a_{ij} and the corresponding employment output ratio e_{ii}. Each employment output ratio is the sectoral productivity inverse which reflects labour intensity by sector. The analogous procedure is also applies for indirect, induced and total multiplier effects obtained from the Leontief inverse matrix.

So far, in the open I-O model, all the categories of final demand are exogenous, meaning that there is no feedback from factor income into demand for goods and services, providing us with simple direct and indirect multiplier effects. This constraint is partially accounted for by the closed I-O model introducing induced multiplier effects as a result of income feedbacks. Therefore, the direct, indirect and induced effects together are known as the total or complete multiplier effects (Table 1), which derived from the closed I-O model (O'Connor & Henry, 1975) and are greater than the simple or partial multipliers derived from the open I-O model.

Therefore, the closed I-O model allows for the evaluation of economy-wide effects within a more articulated productive structure, for example, the effects triggered by changes in the remaining final

Table 1

MULTIPLIER EFFECTS ON OUTPUT AND EMPLOYMENT IN ANALYTICAL TERMS

	Output$_j$	***Employment$_j$***
Direct effects	$\sum_{i=1}^{n} a_{ij} \forall_j$	$\sum_{i=1}^{n} a_{ij} * e_{ij}$
Direct effects	$\sum_{i=1}^{n} l_{ij} - a_{ij}$	$\sum_{i=1}^{n} (l_{ij} - a_{ij}) * e_{ij}$
Direct effects	$\sum_{i=1}^{n+1} l_{ij} - l_{ij}$	$\sum_{i=1}^{n} (l^*_{ij} - a_{ij}) * e_{ij}$
Direct effects[a]	$\sum_{i=1}^{n+1} l^*_{ij}$	$\sum_{i=1}^{n} l^*_{ij} * e_{ij}$

Where:

$a_{ij} = \frac{x_{ij}}{X_i}$ from technical coefficient matrix

l_{ij} = coefficient from Leontief inverse matrix

l_{ij} = coefficient from the augmented Leontief inverse matrix

$e_{ij} = e_j = \frac{employment_j}{output_j}$ = employment output ratio where $j=1 \ldots n$

[a] If instead of summing every cell to get total output multiplier effects, we just consider every activity by excluding household consumption, we obtain the truncated effect which is fully associates with employment ($\sum_{i=1}^{n} l^*_{ij}$).

Source: Authors' elaboration based on Hewings & Jensen (1987).

demand categories (government consumption, exports and capital formation) on sectoral production structure. Following the circular economic flow, further effects can be measured, for example, on factorial and household incomes, and on the feedback effects of household demand into production. Hence, in the closed I-O model, increased wages and distributed profits lead to higher household expenditure demand. The former leads to an increase in the demand for goods and services and this in turn leads to increases in sectoral production (*e.g.* supply). If sector j increases its output, this means there will be increased demands from sector j (as a purchaser) on the sectors whose goods are used as inputs to production in j. This is the direction of causation in the usual demand-side model, and the term "backwards linkages" is used to indicate this kind of interconnection of a particular sector with those (upstream) sectors from which it purchases inputs. In other words, it captures not only direct and indirect effects, but also the induced effects of household income generation through their labour compensation (Miller & Blair, 2009).

In practical terms, the coefficient matrix in the closed I-O model[7] gains one dimension by making household consumption endogenous as a new column in the coefficient matrix and including the analogous income which allows this expenditure as an additional row. Households income is represented, as a proxy, by total labour income defined here as payments for labour services of wage employees and self-employed (see section III). That consequent matrix is known as the augmented matrix A^* and previous specifications are valid when A is replaced by A^*. As previously mentioned, it is the result of including households' incomes and expenditures in the original matrix A and recalculating the multiplier effects, which are known as type II multipliers. Those procedures are also analogous for the augmented Leontief inverse matrix by transforming the open I-O model into a closed one. In this case, the augmented Leontief inverse matrix provides the total output multiplier effects by summing l_{ij} and l_{ij}.

III. The employment dimension of construction

A. Data sources

The main data source in this study comes from the WIOD[8] project, which has developed a dataset for

[7] Although, "closing" the I-O tables yields a model that is somewhat more comprehensive and encompassing, by making a large part of the economic cycle demand (household)-production-factor income-demand-production endogenous, it still does not capture the effects of institutions of income distribution and transfers, nor does it show the sources of users of capital formation and savings or the financial flows among and within domestic institutions and the rest of the world, aspects that are all explicitly introduced as part of a SAM, where savings remain sterile.

[8] www.wiod.org .

27 European Union (EU) countries and 13 other major countries in the world (see appendix I) for the period from 1995 to 2009. All it together accounted more than 88 per cent of the world gross product in 1995 and more than 86 per cent in 2009. At its core lies a set of harmonized supply and use tables at national, regional and global levels with several modules or satellite accounts related to environmental and socioeconomic indicators for each of the 35 industries for which data are available or estimations can be calculated (Timmer, 2012). Outcomes focus on multiplier effects as key instruments for diagnostic on two levels: one related to each economy as a whole, taking into account, as a proxy, the simple average of all its industrial multiplier effects at national level (hereinafter referred to as "overall level"); and the other related to the construction sector, as a proxy of infrastructure investment. Aimed at comparing total output and employment multiplier effects of different economies across countries and over the time, two wide datasets were used:

- National I-O tables denominated in current dollars at purchaser prices. In this regard, in spite of the fact that the linear I-O relations or production functions were assumed to hold in 'physical' terms in the original formulations of the I-O model, it is almost impossible due to most of the information available to build it at current prices (Alarcón, 1991). In order to compare inter-industry flows, some studies suggested eliminating the variation effects in domestic demand and trade patterns without making any attempt to separate the effects of variation in physical inputs and in relative prices (Chenery & Watanabe, 1958).

  According to these authors, the comparison in value rather than physical terms is to a large extent determined by the available data, since a large amount of research would be needed in order to transform the input data into constant prices. In many respects, however, the comparison in terms of value is a more meaningful one if we are interested in the overall pattern of interdependency rather than in minute details. Related to this, and according to the available data, current dollars were preferred to the national I-O tables in previous years' prices. Additionally, since we were faced with analysing ex-post data across time, this study is able to supply changes in relative prices thus revealing the effective impacts of public intervention (*e.g.* infrastructure investment) in monetary terms based on multiplier effects trends and purchasing power evolution within a specific country.

- Socioeconomic accounts, which provided some time series, such as labour compensation at sectoral level, were denominated in national currency at existing prices. It is based on the European Union's KLEMS[9] dataset, which was updated and expanded in order to cover all the WIOD countries between 1995 and 2009. It gathers a lot of usually dispersed data and makes it comparable in spite of the usual difficulties. Information was available for the number of

workers, compensation and total hours worked at sectoral level for employees as well as for persons engaged (employees plus self-employed) (Box 1). The last one was selected as optimal because the number of people employed was greater and three types of skills (high, medium and low) could be analysed according to educational attainment levels (Erumban *et al.*, 2012). Labour compensation was compounded by employment compensation plus self-employed labour incomes (appendix I).

Additionally, an attempt was made to identify different groups. Analytical classifications were used to cluster the countries based on geographical regions and income classification according to 2009 gross national income (GNI) per capita. The income groups were low-income countries (LIC) US$995 or less; lower middle-income countries (LMIC) US$996-3,945; upper middle-income countries (UMIC) US$3,946-12,195; and high-income countries (HIC) US$12,196 or more (World Bank, 2010).

As the WIOD is based on available HIC data and, to a lesser extent, on MIC data, and the EIIP and the EmpIA aim to provide assistance for development of LIC data, the WIOD analysis was complemented with data from the EORA[10] database in terms of I-O tables across time. This enabled a wider outcome focused on the construction sector around the world. Countries such as Morocco, Niger, Paraguay, Sri Lanka and South Africa were selected not only for their income classification, but also for their employment data, which are disaggregated by sector for recent years, as well as for EIIP and other current ILO initiatives (appendix III).

As EORA data covers 1990–2011, it was possible to select the same 15-year period as the former countries (Lenzen *et al.*, 2012 & 2013). According to the available data, several disaggregations by industry and commodity were taken into account to carry out each country I-O table. Pursuing comparability across countries and databases, a homogenous breakdown of 26 activities was taken into account in this study, from which re-exports and re-imports were considered exogenous variables and, therefore, excluded. In fact, it is likely to not significantly affect the economic average of total industries' multipliers.

Since EORA has built environmentally extended multi-regional I-O tables, with a system of satellite accounts related to carbon emissions, water and ecological footprints, among others, it was necessary to look for employment data in order to build the employment satellite account for them. Differentiating employment categories into comparable groups in developing countries, such as Morocco, Niger, Paraguay, Sri Lanka or South Africa, was not

[9] It covers 15 OECD countries until 2007 (see O'Mahony & Timmer, 2009).

[10] http://worldmrio.com/

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Box 1
Trends in hours worked (HW)

Since HW vary from country to country and by time period, the average at domestic level was calculated for all the WIOD countries per year. The simple average shows that hours of work declined smoothly: weekly HW passed from 35.5 in 1995 to 34.1 in 2009, making an average for the period of 35, or a 3.9 per cent drop in HW for the whole period. It was led by HIC (30 out 40), which registered a decrease of 4.96 per cent, from 35 to 33.3, while MIC declined by just 0.9 per cent, from 33.9 to 33.6. As HIC were over-represented, the average weekly HW were calculated for each country based on the total number of persons employed in all industries over a 52-week period.

Therefore, despite the fact that HIC's average employment growth rate was 0.6 per cent; their employment rate adjusted by HW was just 0.26 per cent. In other words, labour market constraints arose as mild employment generation in HIC, even when working time dropped substantially. By then, the analogous rate in MIC was 1.15 per cent and 1.51 per cent, respectively. In terms of change rate, the main divergence between both averages is observed between 2000 and 2003, the period after a sequence of crises in developing countries - Mexico (1994), East Asia (1997), Russia (1998), Brazil (1999), Argentina and Turkey (2001). By that time, the People's Republic of China's GDP growth had risen to above 8 per cent, although India GDP had slowed down, remaining above 4 per cent. China was the only country that registered a huge increase of HW (+11.7 per cent) between 1995 and 2009. Following this rising trend, Denmark, India, Lithuania and Luxembourg increased by 1 per cent. Brazil, Belgium, Romania and Russia showed a mild reduction during the period (around 1 per cent). A pronounced shrinking was noted in Poland and Taiwan (above 8 per cent), in Estonia, Germany, Korea, Slovak Republic and Turkey (above 9 per cent) and in Ireland (10 per cent).

In this regard, when considering the impact of the international economic crisis, it is worth noting that according to the simple average (-1.05 per cent), annual HW decreased the most in 2009 and, according to the weighted average (0.19 per cent), it increased slightly, as can be expected during such a crisis. Before reducing staff, employers start by reducing working time and, during recovery, they increase working time before starting to recruit new staff. Since the weighted average of HW takes into account global changes in employment structure in emerging economies, which have a longer working time, it has been selected as the standard comparative measure. Global average HW weighted by those employed registered an increase of 3.15 per cent during the same period, mainly after 2000, from 37 in 1995 to 38.2 in 2009, giving a global average of 37.5 HW per week. Normalizing the total number of HW by this figure annualized, it is possible to have a measure of full-time equivalent work (FTEW) which reflects hours effectively worked in order to get an homogeneous basis for international comparison beyond changes in legislation and/or working conditions over the time. This equivalence will be used throughout this paper.

Labour intensity is heterogeneous among countries. At the beginning of the period, the gap between the country with the longest working time -Korea with an average of 48.2 HW per week- and the country with the shortest working time -Belgium with 27.5 HW- was 75 per cent. In other words, Korean workers spent three quarters more time at work than Belgian workers. This gap went down by the end of the period analysed, reaching 61 per cent due to a deeper reduction in Korea (43.9 HW) than in Belgium (27.3 HW). India was the country with the longest working time in 2009 with 45.1 HW per week, whereas the country with the shortest working time was the Netherlands with 26.5 HW. This gap reached 70 per cent that year (appendix II).

Source: Authors' calculations based on data from WIOD.

always possible and, as a result, this paper focuses only on jobs. Neither HW nor skills were taken into account. Therefore, there is no common standard of HW as there is for WIOD countries (Box 1).

Official data and estimations were considered when available for the above five countries and, in a few cases, they were complemented or corroborated with data from the World Bank (appendix I). In order to calculate the induced multiplier effect among the other countries, labour compensation was obtained as the sum of employees' compensation and net mixed income, which represents the aggregate labour income of the self-employed after computing depreciation of capital goods. Moreover, these countries are important in learning about the developing world in spite of the fact that they comprise just 0.75 per cent of global GDP.

B. Analysis and main findings

Several studies have discussed the key role of infrastructure for development (Nübler & Ernst, 2011) in spite of persistent infrastructure gaps in different countries. Infrastructure is at the core of the construction sector and is, therefore, a key part of fixed investment at domestic level. In fact, across the whole construction sector there are huge differences in sectoral distributions across countries. According to the WIOD, the construction sector comprises between 4.5 per cent (Bulgaria) and 10.4 per cent (Spain) of the overall gross output in 1995 and between 4.2 per cent (Taiwan) and 14.6 per cent (Spain) in 2009. Regarding total value added (VA), it represented between 4.2 per cent (United States) and 10.1 per cent (Korea) in 1995 and between 2.2 per cent (Taiwan) and 10.8 per cent (Spain) in 2009. In spite of being relatively stable across time, changes depend on the country.[11] Meanwhile, intermediate inputs that the construction sector demands are relatively higher in comparison to aggregated industries: in most of the countries they have explained about 8 per cent and 14 per cent of the total intermediate demand s in 1995, increasing until 18 per cent in 2009 (appendix II).[12]

In this regard, some studies observed that the construction sector in the USA has been greatly affected by business cycles and seasonal patterns (Tschetter & Lukasiewicz, 1983). This sensitivity has had a notable impact on steady employment rates within the sector. Nevertheless, this study

11 Bulgaria and Taiwan are outliers: the first has doubled its share of VA and the second has halved it over the time. Among countries from the EORA dataset, this sector has ranged between 3 per cent and 7 per cent of VA with lower oscillations (less than 1 percentage point).

12 These figures drop to 5-6 per cent in Brazil, Hungary, Korea, Luxembourg, Malta, Sweden, Taiwan, Turkey and the USA, while they reach 18 per cent in Indonesia and 21 per cent in Spain and Latvia during the period. Countries such as Austria, Brazil, Japan, Lithuania, Luxembourg, Malta, Romania, Slovak Republic, Sweden and Turkey, show similar sectoral shares on both GVA and intermediate demand.

aims to provide analytical tools to implement job-rich growth strategies and to develop public-private partnerships in a tripartite framework.

This section provides an overview of output and employment multiplier effects that took place between 1995 and 2009 in the 40 countries covered by the WIOD and in other five covered by the EORA (appendices I, II, III). On the one hand, it takes into account multiplier effects at overall level for all the industries using available data in each country. On the other hand, it assesses labour market outcomes on the construction sector where infrastructure investment is able to lead to GDP growth and job creation, and to support development strategies in the medium term. This section's findings attempt to give an account of the main research highlights. It is structured as follows:

- Firstly, it details trends in output and employment multiplier effects between 1995 and 2009 at overall level as well as in the construction sector according to the World Bank's income classification of HIC, MIC and LIC;
- Secondly, every country was re-clustered according to main trends in their total employment multipliers at both levels. In order to explain different paths among each group, different indicators were built focusing on labour productivity, exchange rate and real labour costs. They are detailed later on, always working at overall level and in the construction sector;
- Finally, a deeper analysis of the construction sector was carried out in order to account for sectoral relative gains or losses in each country across time. Boxes and appendices complement the section.

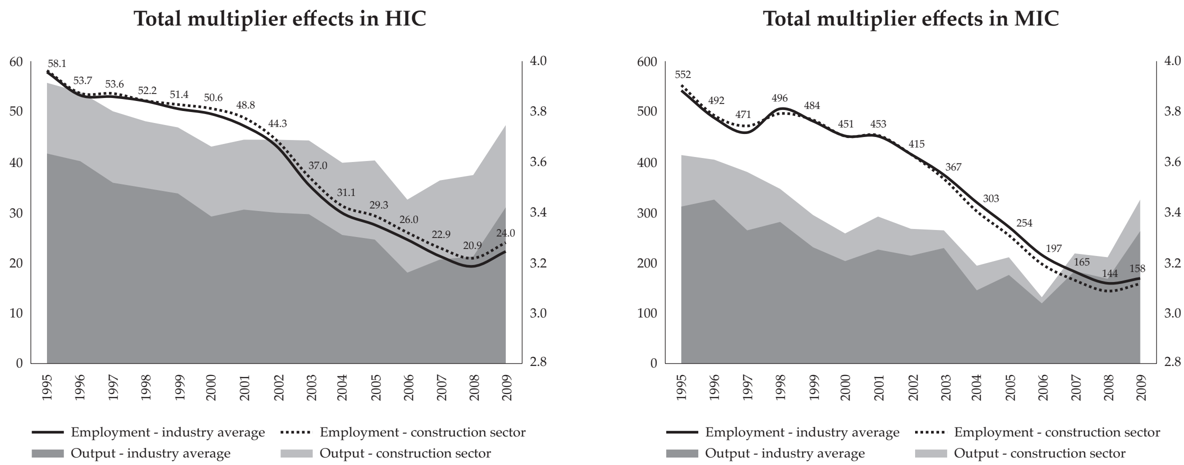
1. *An overview of multiplier effects between 1995 and 2009*

Complete or total multiplier effects account for the size of output or employment expansions in terms of monetary units or jobs, respectively, due to a final demand increase of 1 monetary unit (*i.e.* $1 million). These multiplier effects are the sum of direct, indirect and induced effects and, therefore, capture intra- and inter-industry requirements as well as labour earnings and household consumption.

Total output multiplier effects of MIC and HIC show similar patterns at overall and construction sector levels between 1995 and 2009 (Figure 1). Total multiplier effects declined until 2006: since then, they decreased 13.1 per cent in HIC and 11.3 per cent in MIC at overall level, and 12.1 per cent in HIC and 15.6 per cent in MIC in the construction sector.[13] Later on, total effects showed an upward

[13] This section works with average patterns according to the data used. In order to learn about a specific country, patterns and estimations must be analysed separately. See appendix I for further detail.

Figure 1
TOTAL MULTIPLIER EFFECTS BY COUNTRY INCOME GROUP, 1995-2009



Source: Authors' calculations based on data from WIOD.

trend, recovering levels of the late 1990s, despite the fact that multiplier effects in MIC recorded lower figures than in HIC. The cumulated change end-to-end between 1995 and 2009 was -6 per cent in HIC and -2.9 per cent in MIC at overall level, and -4.5 per cent in HIC and -4.9 per cent in MIC in the construction sector.

It is worth highlighting that the total output multiplier effects in construction sector were higher than the overall level for each group of countries over the period. However, the absolute gap between overall and construction sector multiplier effects was higher in HIC: it registered 0.29 points above the overall in HIC and just 0.11 in MIC.[14] This implies that the construction sector is a stronger driver of gross output growth in HIC than in MIC when compared with their overall level.

Data for LIC and LMIC confirm that construction is a strategic sector in triggering output growth (appendix III). On average, it surpassed the overall level by 13 per cent during the whole period with maximum gaps in 2007 and 2008 (16 per cent and 17 per cent, respectively) and minimum gaps in 2001 and 2009 (11 per cent).

[14] A few exceptions are Austria, Greece, Poland and Slovenia among the HIC and, until 2006, Brazil among the MIC that recorded total output multiplier effects in the construction sector lower than at overall level. HIC, such as Estonia and Hungary, and MIC, such as Lithuania, Romania and Turkey, had output multiplier effects at overall level similar to those coming from the construction sector.

When we decompose total multiplier effects into direct, indirect and induced effects, it is possible to refine the previous diagnostic. Regarding output and focusing on inter-industry linkages, HIC showed that direct and indirect multiplier effects at overall level were lower than those for MIC: -0.04 points and -0.07 points on average, respectively (Figure 2, upper graphs). Nevertheless, HIC induced effects were higher than the analogous in MIC. They not only compensated for the former differences, but also surpassed MIC's total output multiplier effects (+0.36 on average). Due to the fact that in both groups of countries' direct and indirect multiplier effects were steady over the period, whereas induced effects have dropped since 1995, induced effects are able to explain the majority of the changes in total output multiplier effects.

Regarding the construction sector, HIC and MIC registered almost the same direct effects across time and between groups. Indirect effects used to be lower in HIC than in MIC (-0.04). Both these effects, which depend strictly on industrial backwards linkages, were very stable over the time although MIC indirect effects decreased from 1997 to 1998 and, to a lesser extent, in 2008. Similar to the overall level, in the construction sector, induced effects in HIC were higher than the analogous in MIC (+0.36) and accounted for the changes in total output multiplier effects in the sector.

In other words, for each additional million dollars spent, the construction sector would have generated an expansion on gross output of almost four times (3.92 units) in 1995, 3.45 times in 2006 and 3.74 times in 2009 in HIC, whereas it would have led to an output expansion of 3.63 times in 1995, 3.06 in 2006 and 3.45 in 2009 in MIC. Therefore, the potential impact of an additional monetary unit of expenditure on total output growth would be decreasing over the time in both HIC and MIC. Thus, an increasing effort in terms of expenditure would be needed to fulfil output growth goals over that time. A similar dynamic was observed at overall level despite lower figures compared with the construction sector in the two groups of countries. Total and induced multiplier effects reached their lowest levels in 2006. Later on, they started to grow modestly, becoming an exception to their longer trends in HIC and MIC.[15] However, increases in these output multiplier effects were not enough to recover to the levels of the mid-nineties.

Total employment multiplier effects also registered similar patterns at overall and construction sector levels notwithstanding a downward trend across time, presenting slight decreases until 2001 (Figure

[15] For preliminary information, most data are until 2007 with estimations being used later on (appendix I). An initial boom in the price of commodities and the subsequent impact of the international crisis, as well as recovery packages after the crisis can all affect the dynamics. See next sub-section.

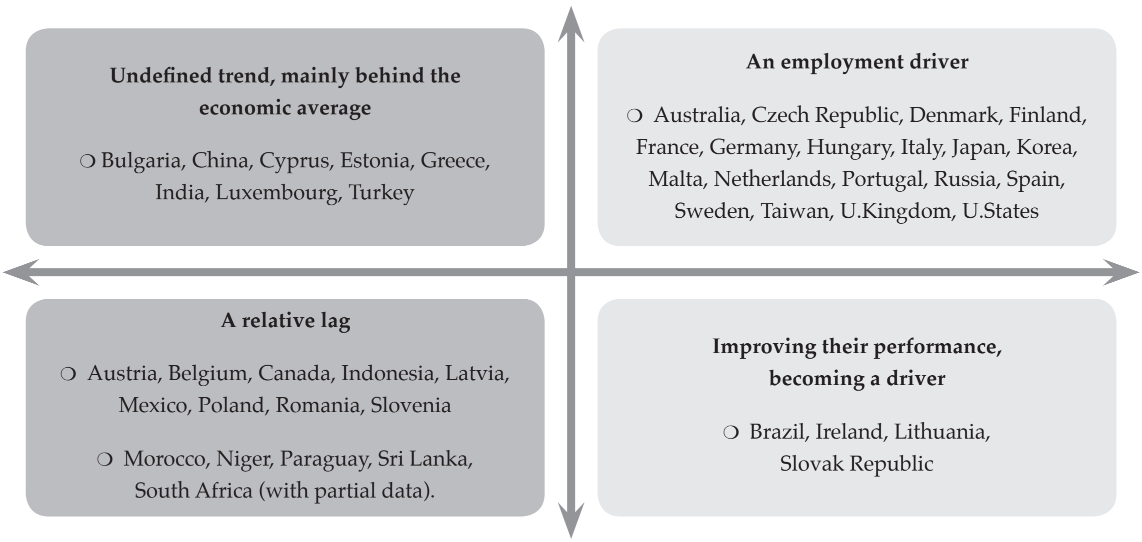
1). After having accelerated, this trend reversed in 2009 to 2007 levels. In fact, all the employment multiplier effects declined in HIC and MIC, although they were much higher than in HIC. Whereas total effects tell us that another million dollars spent at overall level in HIC would have created 57.9 new jobs (FTEW, box 1) in 1995 and 22.2 in 2009 (-61.2 per cent). The equivalent in MIC would have triggered 542 new jobs and 169 (-68.8%) in the same period.

Direct and indirect effects, however, dropped less than total effects: 59.8 per cent and 60.4 per cent in HIC and 64.7 per cent and 64.6 per cent in MIC, respectively (Figure 2, bottom). Induced effects decreased more than total effects and, therefore, deepened total falls: 63.6 per cent in HIC and 73.1 per cent in MIC. Despite being mainly downward after 2002, trends in total employment multiplier effects declined at different rates in HIC and MIC. Total effects in HIC showed a relatively even path in comparison to the analogous in MIC at overall and construction sector levels.

In turn, total employment multiplier effects in the construction sector were higher than those at overall level in HIC and MIC, except in MIC between 1998 and 1999 (Box 2 and next section). Whereas they went from 58.1 new jobs in 1995 to 24 in 2009 in the construction sector in HIC (-58.7 per cent; 2.5 percentage points lower than the overall), they passed from 552 new jobs to 158 in MIC (-71.3 per cent; 2.5 percentage points deeper than the

Figure 2

CONSTRUCTION SECTOR ROLE ON EMPLOYMENT, 1995-2009



Source: Authors' calculations based on data from WIOD and EORA.

overall). Direct effects in the construction sector were higher than at overall level in HIC but they were very similar at both levels in MIC. In turn, MIC indirect effects were systematically lower in the construction sector. In this sector, direct effects dropped 60 per cent in HIC and 64.2 per cent in MIC whereas indirect effects decreased 55.1 per cent and 68.3 per cent, respectively. Similar to output multiplier effects, regarding employment induced effects also pushed to declines in the total multiplier effects in the construction sector of -62.2 per cent in HIC and -74.7 in MIC.

This implies that, on the one hand, the construction sector has reinforced its position in HIC when compared with MIC, whilst, on the other hand, it has led to higher job creation since this sector's intermediate demands were more labour intensive than the economy as a whole. The few exceptions to this trend were Austria, Belgium, Greece and Slovenia, which had lower total employment multiplier effects in the construction sector than at overall level. In LIC and LMIC from EORA, total output multiplier effects in the construction sector were higher than at overall level over the period. However, equivalent employment indicators were significantly lower in the construction sector than at overall level, despite a reduction in the gap between these two levels.

The year 2009 was another exception for HIC and MIC because of slight increases in employment multipliers at overall and construction sector levels; 1998 was an exception just for MIC. In fact, mainly HIC presented output drops which reached 21 per cent at overall level and 40 per cent in the construction sector due to the international crisis in 2009. During that year, HIC registered a fall in employment level of -3.09 per cent, taking into account the number of persons engaged, and -3.89 per cent when the number of workers is adjusted by HW, implying that on average part of employment

Box 2
Employment in the construction sector versus overall level

Looking at each country by itself across time, it is possible to distinguish two opposite groups. On the one side, those countries in which the construction sector has driven employment due to the fact that total employment multiplier effects in this sector level have been higher than the analogous multipliers at overall level during the whole period (see appendices II, III and IV). In other words, every additional dollar spent in the construction sector would on average tend to generate more new jobs than all the industries combined because of its particular backwards linkages. These 19 countries (out 40) are mainly member states of the Organisation for Economic Co-operation and Development (OECD) followed by a subgroup (four) that performed similarly after 2000. On the other side, it is possible to regroup those countries in which this sector has recorded a systematic lag in terms of job creation in comparison with those at overall level. Additionally, although only partial data were available, lower income countries conform to the latter group. See figure below.

Source: Authors' calculations based on data from WIOD and EORA.

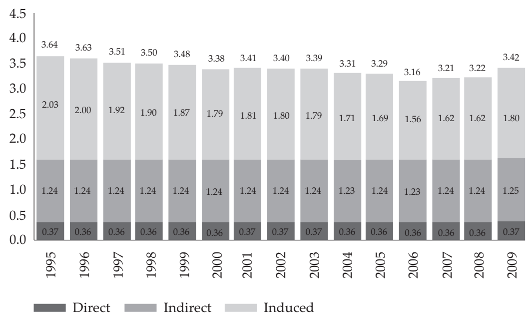
destruction was compensated for by less HW. The dynamic for that year will require further analysis due to the fact that, at first glance, adjustments in employment usually present a lag related to output or GDP changes. Additionally, employment policies and wage subsidies that were implemented in several countries during the recession in order to maintain jobs (Saget, 2013) could have distorted the link between number of jobs and output level by changing trends in multiplier effects. Meanwhile, in 2009, MIC saw a minor increase considering the number of workers (+0.23 per cent) and a large one when adjusted by HW (+0.55 per cent). In 1998, this group also registered employment growth (+0.67 per cent), but when adjusted by a reduction in HW, it dropped by 0.1 per cent.

Figure 3

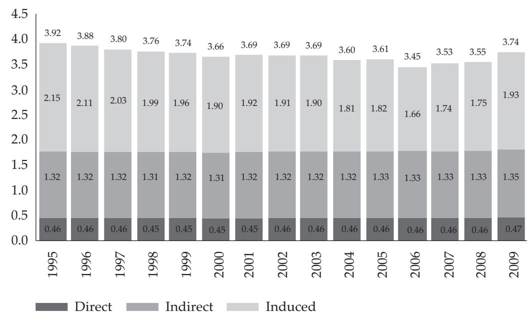
OUTPUT AND EMPLOYMENT MULTIPLIER EFFECTS AT OVERALL AND CONSTRUCTION SECTOR LEVELS, 1995-2009

Output multiplier by effect in HIC

Industry average

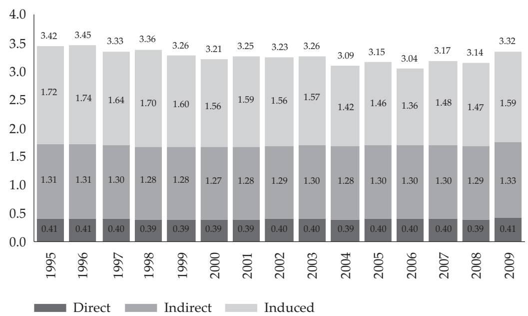


Construction sector

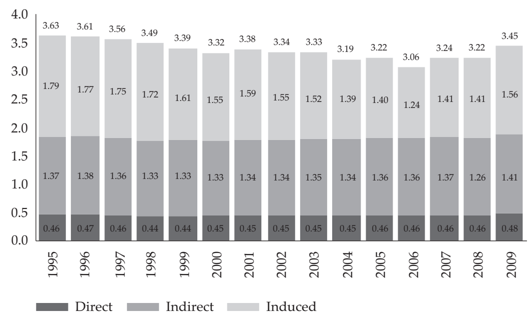


Output multiplier by effect in MIC

Industry average



Construction sector



Source: Authors' calculations based on data from WIOD.

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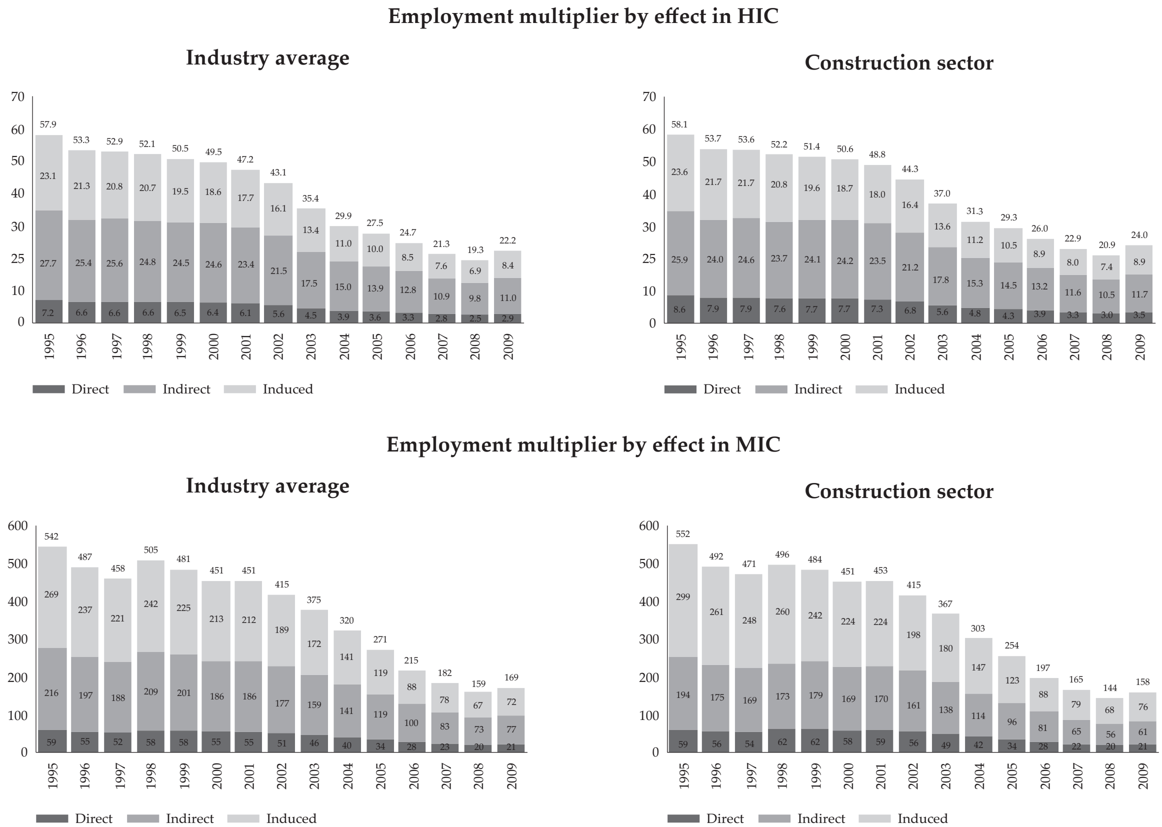
Figure 3

OUTPUT AND EMPLOYMENT MULTIPLIER EFFECTS AT OVERALL AND CONSTRUCTION SECTOR LEVELS, 1995-2009 *(Continuación)*



Source: Authors' calculations based on data from WIOD.

2. *Re-clustering to determine multiplier effects trends in output and employment*

Since previous findings pointed to several issues related to main trends in output and employment multiplier effects at overall and construction sector levels in HIC and MIC, this section identifies six smaller groups of countries according to the evolution of their total employment multipliers at both levels. In order to determine what is behind these single main trends, we focused on the ratio of employment multiplier to output multiplier, which reflects across time sensitivity or elasticity of employment when there is a monetary unit of change output. The clusters are as follows:

- **Western Europe (11)**: Austria, Belgium, Denmark, Finland, France, Germany, Luxembourg, Netherlands, Portugal, Spain and Sweden.[16] These patterns are also related to the following countries, but with some divergences:
  - **European poles (3)**: Ireland, Italy and United Kingdom.[17]
  - **The wider Balkans (7)**: Cyprus,[18] the Czech Republic, Greece, Malta, Romania, Slovenia
- **Eastern Europe (7)**: Bulgaria, Estonia, Hungary, Latvia, Lithuania, Poland and the Slovak Republic.[20]
- **Non-European HIC (6)**: Australia, Canada, Korea, Japan, Taiwan and the USA.[21]

---

16 All of these countries showed an increase in their employment multipliers between 1995 and 1997, the following two years were relatively stable and reached their series maximum in 2000–2001 when the euro was implemented. Later on, all of them declined sharply while in 2009, a smooth increase was observed for all. Most of them were not higher than 30 not lower than 8, few of these countries registered employment multipliers below that, but were still higher than 5. Portugal and Spain were upper outliers due to their multipliers reaching about 60-70 and 45, whereas Luxembourg was a lower outlier because its multipliers reached to 3-4 in the last years. In several cases, employment multipliers for the construction sector were above overall levels whereas the opposite occurred in Austria and Belgium. In Luxembourg, during 1995 and since 2003, employment multiplier effects for the construction sector were below its overall level.

17 These countries demonstrated a smooth decline after the mid-nineties to decrease to a more sustainable level later, similar to the previous group. Multipliers levels were around 30 in Ireland, 35-38 in the UK and 40 in Italy at the beginning of the period. At the end, their levels were around 10 or higher. Prior to 2002, employment multipliers from construction were lower than at overall level.

18 There was no I-O table for this country, therefore, WIOD worked based on the Greek I-O table.

19 In spite of having a similar trend to Western Europe, employment multipliers were wider and they were relatively stable until 2001, starting between 35 and 65 with the Czech Republic and Turkey around 95-115, and Romania higher than 270. Later on, they fell until 2009. Whereas Romania had a maximum in 2000-2001, Turkey showed maximums in 1999 and 2001. Malta, for instance, had a maximum in its multiplier effects from the construction sector in 1999. In most of these countries, employment multipliers from construction sector were below their overall, except in some years in Cyprus and Turkey and the whole period in the Czech Republic and Malta.

20 These countries' employment multipliers decreased sharply between 1995 and 2009. Multiplier effects from construction sectors were very similar to the average, broadly speaking, not much below during the first few years in Estonia and Lithuania. Bulgaria, Latvia and Poland showed a higher average multiplier during most of the years whereas in Hungary it was a little below that for construction. Multipliers started the period around 100-300 and ended it at 30-50, with the Slovak Republic around 20 and Bulgaria around 70.

21 Excluding Canada, all the countries showed an employment multiplier from the construction sector higher than at overall level. In Canada, both were quite close. In most of them, employment multipliers were between 30 and 40 in 1995 and above 17 in 2009. Multipliers for Taiwan and Korea were around 60-70 and 115, respectively, at the beginning, and around 40 and 50 at the end. Meanwhile, the overall multiplier in Japan was 25 in 1995. Whereas in the USA, the trend was downward, Canada registered a small decrease until 2002 and Japan had an inflection point and mild path, with shy peaks in 1998 and 2001-2002; the weakest fall was -23.2 per cent at overall level and s 20 per cent in the construction sector. Taiwan had a similar dynamic with broader levels showing a sharp increase in 1998. They interrupted declining trends of Korean multipliers decline, they surpassed 150. Australia also had peaks in 1998 and in 2000-2001.

- **Emerging economies (6)**: Brazil, China, India, Indonesia, Mexico and Russia.[22]

Throughout these clusters, we are able to suggest further interaction among trade partners or neighbour countries. In other words, policy coordination within regional blocks and/or operation of transmission channels is illustrated by geographical attachment in Asia, Europe and the North American Free Trade Agreement (NAFTA) area according to their own economic performance. A notable reduction in the employment multiplier to output multiplier ratios took place in every cluster (Figure 4, upper graphs), which was mostly explained by decreasing employment multiplier effects over time in HIC and MIC. The ratio between employment and output multipliers is the key difference between the two multipliers. On the one hand, if the output multiplier matrix is stable over time, the cause is a lower ratio resulting from decreases in average labour intensity or, what is equivalent, increases in average labour productivity. Hence, employment creation becomes more expensive in relative terms. On the other hand, if the output multiplier matrix falls, then, the additional explanation is lower interaction at economy-wide level. The reverse is true but no change would be registered if it were compensated.

In fact, In Western Europe and the European poles, this ratio almost halved, passing from 6.6 and 8.5, respectively. Both groups marked the minimum ratios followed by non-European HIC, whose ratio went from 11.2 to 7.3. The wider Balkans registered a stable ratio between 1995 and 2001, 31.6 on average. However, it dropped and did not surpass 11 by 2009. Whereas these four groups had similar dynamics in the construction sector (+/- 1 at most), the remaining groups showed some differences. Eastern Europe passed from 59 in 1995 to 14 in 2009, representing the highest ratio drop (-76 per cent). The construction sector saw a decline from 55 to 14. Finally, emerging economies fell from 186 to 70 at overall level and from 172 to 59 in the construction sector.

It is worth noting the ratio volatility in emerging economies during the period 1998–1999, where total employment multiplier trends in MIC showed a disruption at both overall and construction sector levels. In fact, employment multiplier effects went up sharply in countries such as Indonesia and

[22] This group of countries constitutes the highest employment multiplier effects as well as different trends across time although they experienced long-term decreases. China, India and Mexico presented a simple decline from around 1400, 2000 and 170 to about 210, 670 and 90, respectively. India and Mexico registered a standstill during 1999-2000 and 2000-2004, respectively. The latter had a mild increase in 2009. In addition, Indonesia registered a sharp jump in 1998 (from around 360 to 750-920) to decrease later on. The same occurred in Russia in 1999 (from around 355 to 600-660). Brazil had two maximums, one in 1999 (from 160 to 230) and other in 2002–2003, reaching 270-300 at that time. This country registered the most severe loss in terms of employment multipliers from the construction sector (-10.9 per cent) and followed Japan with the average multiplier (-21 per cent).

Russia, which experienced a depreciation of their exchange rate against the US dollar, the standard unit of measurement in WIOD datasets.

The Indonesian Rupiah depreciated by 260 per cent between 1997 and 1998, and the Russian Rouble by 214 per cent between 1998 and 1999. Employment multiplier reactions (higher multiplier effects immediately after deep currency devaluation) did not last longer than two or three years. In fact, most cases resumed decreasing employment multiplier trends. It is likely that these trends are partially explained by global changes in production and labour organization.

According to the above-mentioned changes in employment growth, changes in exchange rates seem to have a broad impact on employment multipliers among emerging countries in contexts of severe economic crises. This is not only because they usually provoke shifts in relative prices[23] but also because labour as a factor of production becomes cheaper. Looking for further explanation, we focused on several relationships in order to understand the dynamic of the ratio of employment multiplier to output multiplier over the time, the pattern of real labour costs in US dollars per unit of output was, therefore, decomposed into the following indicators (Box 3):

- real labour cost: hourly labour compensation deflated by output prices;
- labour productivity; and
- nominal exchange rate across countries.

Regrouping the first and last components, we get the nominal hourly labour cost in US dollars and the purchasing power of the dollar in each country. By multiplying the latter with the inverse of labour productivity, it is possible to approximate the employment multiplier to output multiplier ratio, putting aside hourly labour compensation. These variables together forms the deflator set of labour compensation and could be understood as the real cost of the US dollar in domestic currency -nominal exchange rate deflated by prices- compensated by labour productivity. In this regard, employment multiplier to output multiplier ratio and the real cost of the US dollar (in domestic currency compensated by labour productivity) registered a correlation coefficient of 0.99 or higher between 1995 and 2009 at overall level and in the construction sector by country and by cluster.[24] Hence, since the output multiplier matrix was

[23] This dynamic is partially associated to local prices and each currency's purchasing power. Price indexes grew between 1995 and 2009 with heterogeneous intensity, for instance, whereas in the USA it doubled, in Mexico it multiplied by five. At the same time, construction prices increased above all other industries' average in almost all the countries.

[24] Exceptions are Romania (0.77), Luxembourg (0.97), wider Balkans (0.98) and Lithuania (0.98) at overall level and Romania (0.88) and Bulgaria (0.97) in the construction sector.

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Box 3
Labour costs and structural variables

Unit labour costs (ULC) are usually calculated as the ratio of total labour costs (labour compensation) to real output or the ratio of labour compensation per hour, or per employee, and labour productivity (Neef & Thomas, 1988; ILO, 2002). These ratios measure the average costs of labour per unit of output, linking them directly to labour productivity because a rise in productivity leads to reductions in ULC, whereas if ULC increase more than productivity, ceteris paribus, they could affect cost competitiveness of a certain sector or economy.

In this regard, it is important to denote that ULC only reflect cost competitiveness but they are not a comprehensive measure of competitiveness. When labour costs are also deflated by prices, we obtain ULC in real terms (see formula 1). At sectoral level, for instance, it reflects whether or not labour costs could be compensated by price increases. In this case, the denominator is the nominal output instead of the real output and, therefore, this ratio is equivalent to the wage share. Finally, both terms should be deflated by a common currency or its evolution to make cross-country comparisons (see formula 2). However, if we work with index numbers, exchange rate evolution will be balanced.

$$1.\ ULC_r = \frac{Labour\ comp}{Output_n} = \frac{W_h * Emp_h}{Output_n} = \frac{W_h}{\dfrac{Output_n}{Emp_h}} = \frac{W_h}{\dfrac{Output_r * P\ output}{Emp_h}}$$

$$2.\ ULC_{r\ in\ USD} = \frac{W_h}{P\ output} * \frac{1}{\dfrac{Output_n}{Emp_h}} * \frac{ER}{ER} = \underbrace{\frac{W_h}{ER} * \frac{ER}{P\ output} * \frac{1}{\dfrac{Output_n}{Emp_h}}}$$

$$ULC_{r\ in\ USD} \rightarrow LC_{h\ in\ USD} * USD_{\substack{purch.\\ power}} * (productivity)^{-1}$$

Where:

ULC_r = real labour cost per unit of output; sub index r denotes real terms
W_h = hourly labour compensation
Emp_h = number of HW by wage employee and self-employed in this study
P_{output} = output price index; all the indexes are base 1995=100
ER = exchange rate (domestic currency per US dollar); sub index *USD* denotes US dollar units

In spite of that, appreciations are associated with increased turbulence within the labour market (*e.g.* job creation, destruction and excess reallocation increase) (Gourinchas, 1999, p. 173; Backus, 1999, p. 208-212). Conversely, during phases of depreciation, the tradable sector chills as creation and destruction rates fall. In addition to finding the strong statistical relation between exchange rates and real variables, particularly, job flows; Gourinchas concludes that the effects of exchange rates on employment are small, but they are significant, small effects on net job flows, and larger effects on gross flows. Therefore, exchange rate movements explain part of the variance in job creation and destruction, which move the same way: appreciation raises both, and in this sense leads to labour market turbulences.

For instance, a recent study found that rapidly ULC growth and, thus, deteriorating cost competitiveness has been a feature of the Central and Eastern European countries during, at least, the previous decade (Havlik, 2010). Adjusted for exchange rates, ULC have almost doubled in most of those countries since 2000. Among those countries with fixed exchange rates, lack of exchange rate flexibility resulted in a rise in ULC as their GDP and their labour productivity fell while wages increased. Therefore, they usually resolve the issue by cutting (real) wages or reducing employment to compensate for output decreases. In order to mitigate it, competitive devaluation seems to be an instrument to gain cost competitiveness.

Source: Authors' elaboration.

quite stable over time in most of the countries, but had the tendency to decrease slightly (see section III.1)-, the performance of the real cost of the US dollar in domestic currency compensated by labour productivity seems to explain almost perfectly why these ratios fall and, therefore, why employment creation becomes more expensive.

Whereas labour productivity at overall level grew steadily, it performed poorly in the construction sector: Eastern Europe grew before 2002 (36 per cent cumulative), the year in which the emerging economies began to grow faster. The construction sector's labour productivity in the wider Balkans expanded during the whole period, except in 2009, but decreased in the European poles after 2004 (Figure 4, centre). Broadly speaking, real ULC decreased significantly until 2000 at overall and construction sector levels in all the groups (Figure 4, lower graphs). Eastern European countries registered the lowest fall and they accounted for a smooth increase in the construction sector from 1999 to 2000 related to the previous years' levels. Later on, when all the countries started increasing their real ULC, Eastern Europe also presented the lowest increase. In spite of that, emerging economies kept reducing these costs slowly until 2006, mainly because of productivity growth. Meanwhile, countries in the European poles was the only group which surpassed 1995 levels after 2006 at overall level and after 2004 in the construction sector, which was also related to productivity outcomes.

Looking at the figure for 2009, real labour costs per hour remained around or slightly below[25] 1995 levels in most of the regions. Only the construction sector of the wider Balkans grew below its overall productivity, making these countries' ULC more expensive during the whole period. However, 1995 levels were surpassed by emerging economies after 2004 and by the European poles after 2007. ULC dropped the most in Eastern Europe (to 30 per cent in 2002 and 20 per cent in 2009). Exceptions were the European poles and the wider Balkans, which grew significantly. At overall level, all the UCL went down reaching the minimum between 2006 and 2008. The European poles perceived the minimum ULC in 2000, whereas the wider Balkans during the whole period noticed a higher ULC than in 1995.

As regards exchange rates, Western European countries, the European poles and non-European HIC experienced mild depreciation (exchange rate increase related to the USD) in their currencies in 2000-2001 after the introduction of the Euro. However, this real exchange rate went gradually down (local currency appreciation), with the exception

[25] At overall level, the lowest decrease registered 14 per cent in 2009 in Eastern Europe and the wider Balkans when compared to 1995 figures. Emerging economies, which dropped 55 per cent, constitute an exception. In the construction sector, Eastern Europe saw the highest drop compared to 1995 (-18 per cent).

of 2009. In this case, geographical attachment due to membership to a monetary union seems to have been the cause whereas, in other cases, trade flows were more relevant. Eastern Europe presented a sharp increase in 1997, which was mainly led by the depreciation of the Bulgarian currency after reaching a hyperinflation peak. Later on, it grew until 2001 and then gradually decreased, although it did not reach 1995 levels. In this regard, most of the MIC experienced high inflation rates, which led to sharp currency devaluations and, at least, a partial pass-through effect,[26] counteracting the initial depreciation effect.

Meanwhile, the wider Balkans' currencies depreciated eight times up to 2002, reaching the highest depreciation across the groups. Turkey led (with an average of 66 per cent annually) followed by Romania (with an average of 53 per cent annually). Emerging economies recorded twofold depreciation until 2002. It was headed by Russia (43 per cent annually), Indonesia (40 per cent) and Brazil (on average 19 per cent). In addition to changes in relative prices, domestic prices began to increase over the time: after experiencing accelerated growth in 2005-2006, and continued to increase with the exception of 2009 in European poles, the wider Balkans and non-European HIC.

Empirical findings show that, jointly, all deflators of labour compensation in US dollars constitute a set of key variables (Figure 4, upper graphs, lighter lines) and are able to approximate employment multiplier to output multiplier ratios cross-cluster (Figure 4, upper graphs, darker lines). With the evolution of this ratio, the deflators together accounted for a discrepancy lower than 10 per cent during the whole period. The wider Balkans is an outlier, mainly explained by the dynamic of Romania since its deflators doubled this ratio. The construction sector, however, adjusted less than the overall level since countries such as Bulgaria, Lithuania and Russia presented higher discrepancies than the majority (around 20 per cent and 30 per cent).

All these variables together account for the fact that job creation and, in particular, the sensitivity of employment to gross output have interconnections with several macroeconomic dimensions, such as domestic prices, geographical attachment and trade channels, monetary policy, investment and labour productivity, among others. In fact, these deflectors become much more significant than just labour compensation in foreign currency which is usually taken into consideration as a measure of competitiveness. They reflect structural conditions paths and are unlikely to be affected in the short term; especially in terms of deep shocks on economic growth, exchange rate depreciation or hyperinflation.

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[26] Passive movements of domestic prices in response to an exchange rate shock, which are usually higher among those economies that are mainly primary commodities producers.

Figure 4

RATIO OF EMPLOYMENT MULTIPLIER TO OUTPUT MULTIPLIER AND KEY VARIABLES

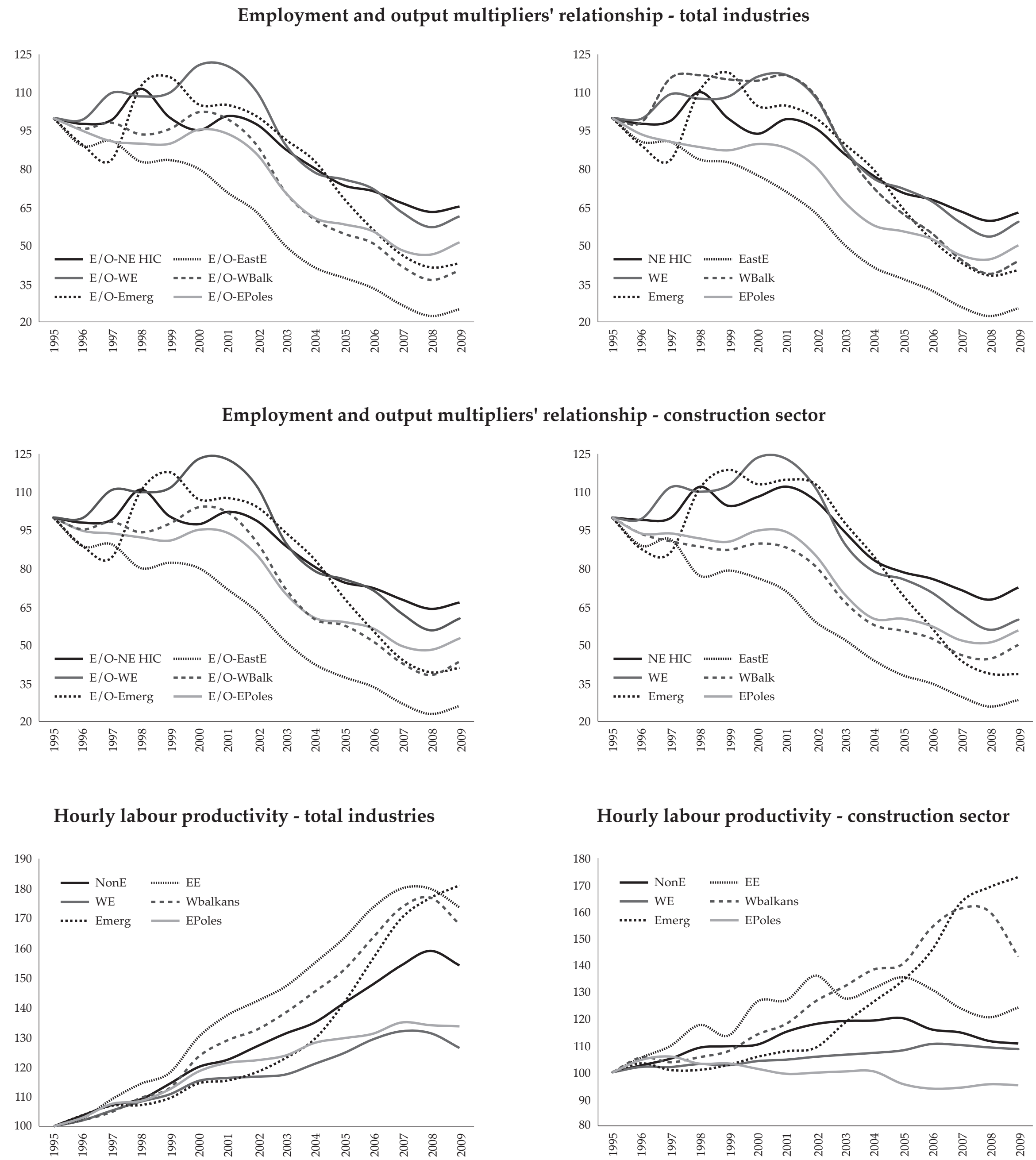

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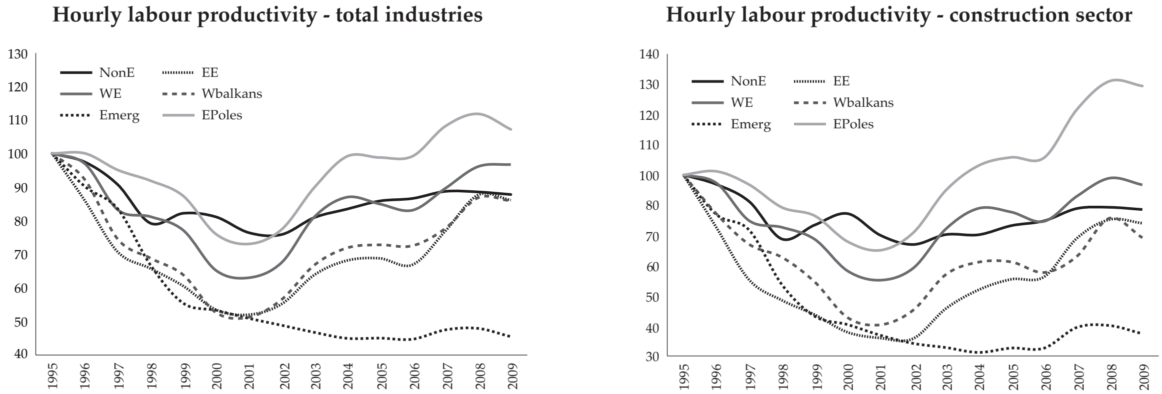
Figure 4

RATIO OF EMPLOYMENT MULTIPLIER TO OUTPUT MULTIPLIER AND KEY VARIABLES

(Continuación)



E/O = employment and output multipliers; NE HIC = non-European high-income countries; WE = Western Europe; Emerg = emerging economies; EastE = Eastern Europe; Wbalk = wider Balkans; Epoles = Eastern poles.
Source: Authors' calculations based on data from WIOD.

3. *Intra-country comparison: A domestic ranking for the construction sector*

Comparison of cross-time analyses between and within economies at overall and construction sector levels and the previous clustering denoted main trends, potential policy targets and differences in/among several countries. Hence, this section aims to identify the way in which total output and employment multiplier effects evolved within borders between 1995 and 2009 in order to have a full picture, and look forward to providing accurate information for policy design in the construction sector. To do that, we have established a domestic ranking among all the activities to ascertain whether the construction sector has remained constant according to its relative position in terms of output and employment multipliers.

Looking at the <u>left-upper quadrant</u> (Figure 5), we can see all the countries which improved their position in terms of total employment multiplier effects in the construction sector relative to other industries but worsened their relative position according to total output multiplier effects (*e.g.* Canada, Hungary and Lithuania). In the first case, output multiplier effects dropped to the same position as manufacturing and recycling in 1995, whereas total employment multiplier effects took the same position as textile and textile products at that time. Employment (FTEW) remained relatively stable at overall level while, between 1995

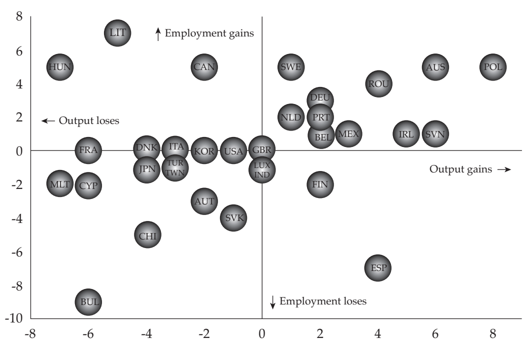
and 2009, it went up in the construction sector on average by 2 per cent per year. At the same time, output growth increased on average by 3 per cent at overall level and on average by 2 per cent in the construction sector.

In Lithuania, total output multiplier effects in the construction sector dropped in 2009 to the place that electrical and optical equipment production had occupied in 1995, while total employment multiplier effects went to the position that financial intermediation had had that year. Overall output grew more than in the construction sector (an average of 7 per cent and 5 per cent per year, respectively) with a similar employment performance for both levels. Meanwhile, in Canada, construction output multipliers fell in 2009 to the previous food, beverages and tobacco manufacturing sector's place, and construction employment multipliers rose to the previous leather and footwear production's position. Between 1995 and 2009, Canadian employment (FTEW) in the construction sector had grown faster than the overall (an average of 3 per cent and 1 per cent per year, respectively) with a similar output performance in these two levels.

The <u>left-lower quadrant</u> concentrates all the cases in which the ranking of total output and employment effects declined. The greatest relative losses were registered by Indonesia (1), 12 steps below in output and 7 in employment (outside of the chart), followed by Bulgaria (2) and, to a lesser extent, China (3) and Russia (4). In these four countries in 2009, total output multiplier effects in the construction sector occupied the following positions: (1) transport equipment; (2) community, social and personal services; (3) pulp, paper, paper, printing and publishing; and (4) rubber and plastics, respectively. For employment, the construction sector replaced: (1) electricity, gas and water supply; (2) mining and quarrying; (3) water transport; and (4) community, social and personal services. Although employment growth in the construction sector was higher than at overall level in Bulgaria, China, India, Slovak Republic and Turkey between 1995 and 2009, both levels evolved similarly in Cyprus, Luxembourg, Malta and Russia, registering a relative stagnation. As employment (FTEW) went down in the construction industry in Austria, Japan, Indonesia and Taiwan, employment destruction at overall level took place in Japan, Slovak Republic and Turkey.

Figure 5

RELATIVE RANKING CHANGES OF THE CONSTRUCTION SECTOR, 1995-2009



For key to country codes, see appendix I.
Source: Authors' calculations based on data from WIOD.

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A particular case of this previous group refers to those countries that are on the horizontal axis. They experienced relative decreases in output effects but no relative change in terms of employment. For example, Denmark saw neither gains nor losses in terms of employment but output went down four places. In the construction sector, employment grew on average 1 per cent per year and at overall level around 2 per cent. Those that did not change at all are located where axes cross each other. In spite of that, with the exception of the Czech Republic and Korea, these countries had a sectoral employment average growth slightly higher than at overall level. Also with the exception of Korea (+6 per cent) and the Czech Republic (+4 per cent) at overall output level, average growth ranged between -1 per cent and 2 per cent over the period.

The right-upper quadrant groups the countries that have performed better in terms of output and employment simultaneously. Brazil, Estonia and Greece (outside of the chart) recorded the highest change in relative positions. In the first case, the gains in terms of output (+23 per cent) were greater than the gains in terms of employment (+8) multiplier effects, taking the places that community, social and personal services and wood and products of wood and cork had occupied in 1995. In the second case, both these gains were identical (+12 per cent), taking the places formerly occupied by inland transport and sale, and maintenance and repair of motor vehicles and motorcycles. In Greece, the improvement in employment (+12 per cent) was double that of output (+6 per cent). Employment growth in the construction sector was higher than at overall level in most countries. However, both levels evolved similarly in Belgium, the Netherlands, Portugal and Romania, registering relative stagnation. In Germany, employment in the construction sector went down (on average -2.6 per cent per year) and remained stagnated at overall level.

The right-lower quadrant puts together those countries which, showing declines in terms of employment in comparison with industries at overall level, moved forward within the national ranking of total output multiplier effects. Examples are Latvia (outside the chart, +10 per cent and -4 per cent) and Spain. Whereas Latvia displaced to the previous position of hotels and restaurants (output) and pulp, paper, printing and publishing (employment), Spain did the same with health and social work and inland transport, respectively. In spite of that, output and employment growth in the construction sector was higher than at overall level but it was not strong enough to maintain the ranking position of employment multiplier effects over the period.

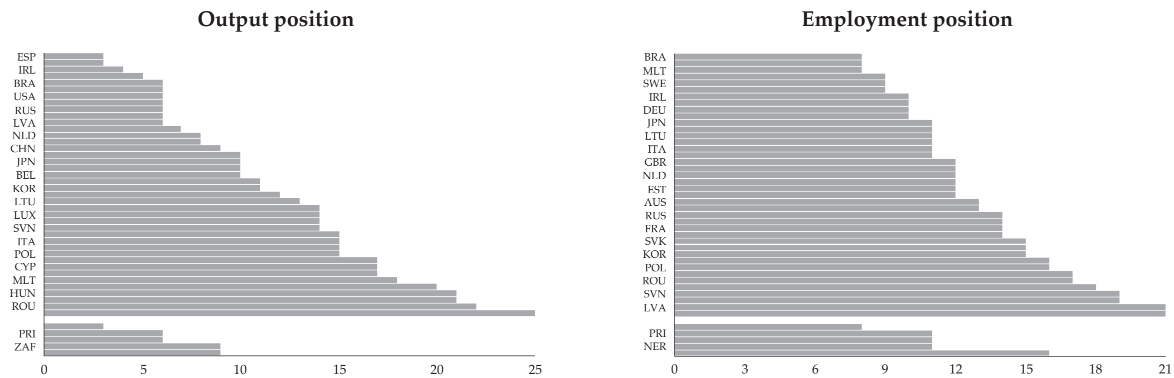
Briefly, most of the countries are concentred in the left-lower corner and the right-upper corner of the figure, implying that, broadly speaking, relative positions of output and employment multiplier effects in the construction sector change simultane-

ously in the same direction within borders. Hence, in addition to the main patterns observed in the previous section, it is possible to observe certain synchronicity amongst the evolution of outcome and employment multiplier effects. However, it is unlikely that one could establish a simple direct relationship between output and employment generation through their analogous multiplier effects and their place in HIC and MIC countries in 2009 (Figure 6). However, further analysis should be done in order to distinguish heterogeneity in multiplier performance country by country. According to total output multiplier effects, the construction sector ranked between third and 25th, leaving off the last third of the positions, if Turkey was excluded from the WIOD. As far as employment multipliers are concerned, the construction sector is more concentrated. Most of the countries (35/40) were ranked in the 2nd quarter; positions 8 to 17 out of approximately 34, excluding private households with employed persons (appendix I). The remainder (5/40) took place until the 21st position.

However, among LIC and LMIC, it is possible to observe lower employment and output multiplier positions, although their positions are different and, therefore, the sample would need to be amplified. According to output multiplier effects, the construction sector in these countries ranked between third and ninth places, covering half of this ranking (24 sectors excluding households, appendix I). As far as employment is concerned, multiplier effects ranked in the second quarter. Among them, employment intensive sectors usually ranked first with wide differences related to the construction sector, such as food and beverage, textile, wood, education and health, hotels and restaurants.

Figure 6

RANKING OF THE CONSTRUCTION SECTOR AT DOMESTIC LEVEL IN 2009



For key to country codes, see appendix I.
Source: Authors' calculations based on data from WIOD and EORA.

IV. Key findings and final remarks

In order to provide analytical tools to implement job-rich growth strategies and develop public-private partnerships in a tripartite framework, this research has identified structural economic trends in 45 HIC, MIC and LIC between 1995 and 2009. Focusing on output and employment multiplier effects in the construction sector and at overall level, it underlines that the construction sector is crucial for economic growth and employment creation.

According to country aggregation by income level, the main findings, based on closed input-output models with data from WIOD and EORA, are as follows:

- The construction sector in HIC presented, on average, output and employment multiplier effects higher than those at overall level. Meanwhile, the construction sector in MIC registered, on average, output multiplier effects higher than those at overall level whereas employment multiplier effects were similar to those at overall level (it was slightly higher than at overall level until 2002, except in 1998, when it was lower than the overall, and after that became slightly lower). When we split total effects, the relationship was almost the same. Direct, indirect and induced multiplier effects in the construction sector were higher than at overall level in both income groups over the period. However, there are two exceptions: MIC induced effects on output have been lower than the overall since 2004 and MIC indirect effects on employment have also remained below the overall.

- The construction sector in LIC/LMIC from EORA showed that, in spite of having higher output multiplier effects than at overall level, employment multiplier effects are much lower than at overall level. In this sense, despite data constraints, preliminary findings reveal that the construction sector in countries with lower incomes presents a paradox: the positive relationship between output growth and job creation which operates in HIC and, to a lesser extent, in MIC seems to be broken.[27]

Therefore, the expansion in output and employment generated by a certain amount of money invested in the construction sector has been wider than the equivalent amount spent, on average, in other sectors of HIC between 1995 and 2009. This pattern was also observed among MIC, with the aforementioned exceptions. Additionally, whereas

[27] In spite of registering a positive relationship between output and employment multipliers in the construction sector in most of the countries, there is no unique relationship between the position that the construction sector occupies at domestic level in terms of output and employment multiplier effects in 2009. However, further research could identify whether the construction sector has low employment multipliers in LIC and/or LMIC because this sector is not developed enough or vice versa.

total employment multiplier effects in HIC were much higher than at overall level, they were similar to the overall in MIC and much lower in LIC/ LMIC, in spite of having reduced this gap over the time. This implies that in HIC, the construction sector is a stronger driver of gross output growth than in MIC when compared with overall level. Thus, the link between each country's income level and its capability to create employment at economy-wide level suggests that there are clear and different trends related to and the patterns of growth.

Hence, as the government is usually a major player in construction, in particular in terms of funding, it can have the role to steer or influence construction investments in a way to promote more labour-intensive subsectors as well as decent work. In specific circumstances (*e.g.* tertiary roads), labour-intensive infrastructure investment (or even public works) could be an option and not only lead to build and improve adequate infrastructure and facilities, but also to ensure particular considerations with regard to labour quality and intensity of public expenditure in order to contribute to employment creation and thus to human development according to each country features. This point appears as strategic for LIC and LMIC in comparison to HIC due to the fact that the first groups present, in addition to lower income, limited capabilities for job creation in the construction sector in comparison to their own overall level.

Broadly speaking, construction-sector relative positions in terms of output and employment multiplier effects change simultaneously in the same direction at domestic level in most of the countries surveyed. Hence, it is possible to observe certain synchronicity amongst the evolution of outcome and employment multiplier effects within borders. However, it is unlikely that a simple direct relationship between output and employment generation could be established through their analogous multiplier effects and their place within HIC and MIC countries in 2009.

Taking the few cases from EORA to draw a conclusive diagnostic, these findings suggest that the size of employment multiplier effects in the construction sector in comparison with those at overall level is related to the income level of each country. In this regard, the comparative lack of physical capital in LIC and LMIC tells us that additional efforts are needed in order to increase the construction sector's infrastructure and labour productivity, which would most likely create a virtuous cycle between growth, employment and investment for development.

Total output multipliers trends presented a decrease in HIC and MIC at overall level as well as in the construction sector. In spite of that, this trend was partially reverted after 2006, which, for instance, could have been triggered by global deflation after the commodities' prices boom. By 2009, total output multipliers had reached 1998-1999 levels.

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- The sum of direct and indirect requirement (inter-industry linkages) was higher in MIC than in HIC. However, induced effects used to be lower in MIC and led to a total lower multiplier effect. If MIC were to have lower real wages than HIC, labour earnings and household consumption would be undermined in the first group and, therefore, lead to lower induced and total effects. Thus, primary income distribution and domestic consumption capabilities become strategic factors for industrial linkages development and, therefore, for job creation.

- In addition, since direct and indirect requirements have been relatively stable over time whereas induced effects have been more volatile, the latter would explain changes of total multiplier effects. In this regard, induced multiplier effects seem to constitute a key target for policy design since they have been the only multiplier effect sensitive to changes over time. Contrary to what was expected in a context of production fragmentation, stability of industrial requirements just allows us to infer that the structure of intermediate demand remains the same and, therefore, structural change has no significant place during the analysed period.

Total employment multipliers trends accounted for a sharp decline at overall level and in the construction sector, particularly after 2001. Hence, empirical evidence denotes a structural bottleneck since the capability of each additional million dollars to create jobs has dropped. In other words, a higher amount of investment (or expenditure) and a higher labour-intensity of these investments would be needed to achieve employment growth goals.[28] The smooth reversion of this decreasing 2009 trend could, therefore, be explained by policies implemented at global level to preserve employment in the face of the consequences of international crises. These trends were also confirmed by LIC and LMIC.

- Since employment multipliers in the countries covered by WIOD were based on full-time equivalent jobs, in order to compare all the countries under a homogenous indicator of hours worked, reduction of working time in most of the countries has helped to compensate changes in employment levels. The fact that working hours decreased over the time, with only a few exceptions, intensifies the decreasing trends of employment multipliers.

- However, employment multiplier effects based on data from EORA just took into account jobs

[28] Note that the educational level of workers has improved in every country over time, labour productivity has increased in most of them -even though following different patterns- (Figure 4) and labour costs in nominal terms have been increasing, even though real labour cost have necessarily not increased. See below.

because of constraints related to hours worked. Since almost all the countries from WIOD revealed a decrease in hours worked, it is possible to state that, if global trends on working time were corroborated among LIC and LMIC, their employment multiplier effects could have been deeper than those we can report on using the available data.

- Disaggregating total employment multiplier effects, we can see that direct and indirect requirements declined in HIC and MIC both at overall level and in the construction sector. Induced effects dropped more than direct and indirect effect during the whole period and, therefore reduced their share of total multiplier effects.[29] Reinforcing output-related findings, induced effects should become a focus for policy implementation since they are the most volatile, especially in MIC, in order to avoid job destruction and promote job creation.

To explain these previous trends by country income, we re-clustered countries in six groups with particular dynamics in terms of employment multipliers and, to a lesser extent, in terms of output multipliers at overall level and in the construction sector. Focusing on the ratio of employment multipliers to output multipliers, which reflect sensitivity or elasticity of employment when there is one monetary unit change for the output, we observed that it declined in all the groups at overall level and in the construction sector. This ratio went down the most in Eastern Europe, followed by the wider Balkans, emerging economies, the European poles, Western Europe and non-European HIC. In the last group of countries, this ratio felt by one third. Whereas in most countries the construction sector went down by 1–2.8 percentage points more, in emerging economies and in Western Europe, it increased 0.9 and 3.4 percentage points, respectively.

- Based on an approximation of <u>the real labour cost per unit of output</u>, the deflators of the labour cost in foreign currency, except for the US dollar, constitute a set of key variables to explain the evolution of the ratio of employment multipliers to output multipliers over the period. They become much more important than the hourly labour cost in foreign currency which is usually taken into consideration as a cost competitiveness measure. Clearing formulas, this set could be understood as the real cost of

[29] In spite of that, the share of induced effects has been much higher among MIC (from 50 per cent and 54 per cent in 1995 to 43 per cent and 48 per cent in 2009 at overall level and in the construction sector, respectively) than in HIC (from 40 per cent and 41 per cent in 1995 to 38 per cent and 37 per cent in 2009 at overall level and in the construction sector, respectively). In addition, the higher share of indirect multipliers to the overall over the time tended to compensate the most of the induced effect share drop (direct effect share changed slightly).

the US dollar in domestic currency, nominal exchange rate deflated by prices, compensated by labour productivity.

- Whereas labour productivity at overall level grew steadily, it had a poor performance in the construction sector with differences among clusters, involving a relative stagnation. In the construction sector, it went up significantly in emerging economies and the wider Balkans, except in 2009.In non-European HIC, Eastern Europe and the European poles it decreased after 2004-2005; in the latter 2009 levels were lower than in 1995.

- Related to the exchange rate, Western Europe, the European poles and non-European HIC presented a mild depreciation of their currency related to the US dollar in 2000-2001, after having implemented the Euro. In this case, geographical attachment seems to be because of membership to a monetary union. In other cases, trade flows could be the main axis. In addition, most of the MIC experienced high inflation rates, which led to sharp currency devaluations and, at least, a partial pass-through effect, which partially destroyed the initial depreciation effect. In addition to changes in relative prices, domestic prices have been increasing following accelerated growth in 2005–2006, and continued growth thereafter, with the exception of 2009, in the European poles, the wider Balkans and non-European HIC.

All these variables together account for the statistics seen in job creation and, in particular, for the sensitivity of employment to gross output, and have interconnections with several macroeconomic dimensions, such as domestic prices, geographical attachment and trade channels, monetary policy, investment and labour productivity, among others. Macroeconomic coordination becomes a key instrument. In addition, specific policies could also lead to changes or reversals in trends. Wage earnings and purchasing power also matter because of their impact on household consumption.

Bibliography

Alarcón, J. (1980). Handbook of economic model building for economic planning. Geneva: Social Security Institute (mimeo).

Alarcón, J. (1991). The input-output system and the social accounting matrix. In Alarcon, J. *et al.* (eds.), *The social accounting framework for development: Concepts, construction, and applications* (pp. 117–163). Aldershot: Avebury.

Alarcón, J. & Vos, R. (1989). *Medium-term stability of input-output coefficients*, ISS Working Papers Series No. 33. Rotterdam: Erasmus University.

Alarcón, J. (2006). *Social accounting matrix-based modelling, extension to well-being and environment and computable general equilibrium models applications using the SAMs of Ecuador 1975 and Bolivia 1989* (2nd ed.). The Hague: Den Haag.

Backus, D. (1999). Comment on Exchange rates and jobs: What do we learn from job flows? *NBER macroeconomics annual*, Vol. 13, pp. 208-212. Cambridge: National Bureau of Economic Research, Inc.

Bulmer-Thomas, V. (1982). *Input-output analysis in developing countries*. Chichester: John Wiley and Sons.

Chenery, H. & Watanabe, T. (1958). *An international comparison of the structure of productio*n. Econométrica, 26, 487-521.

Dervis, K.; de Melo, J. & Robinson, S. (1982). *Planning models and development policy*. London: Cambridge University Press.

Erumban, A. et al. (2012). *WIOD socio-economic accounts (SEA): Sources and methods*. Groningen: WIOD.

Ghose, A., Majid, N. & Ernst, C. (2008). *The global employment challenge*. Geneva: ILO.

Gourinchas, P.O. (1999). Exchange rates and hobs: What do we learn from job flows? *NBER macroeconomics annual*, 13, 153-208. Cambridge: National Bureau of Economic Research, Inc.

Havlik, P. (2010). *ULC, ER and responses to the crisis in CESEE*. Vienna: Institute for International Economic Studies.

Hewings, G. & Jensen, R.D. (1987). Regional, interregional and multiregional input-output analysis, in P. Nijkamp (ed.), *Handbook of regional and urban economics* (295-355). Amsterdam: Elsevier.

International Labour Office (2002). *Key indicators of the labour market 2001-2002*. Geneva: ILO.

Lenzen, M. *et al.* (2013). *Building Eora: A global multiregional input-output database at high country and sector resolution, economic systems research*. DOI:10.1080/09535314.2013.769 938.

Lenzen, M. *et al.* (2012). *Mapping the structure of the world economy*. Environmental Science and Technology, 46 (15), 8374–8381. DOI:10.1021/es300171x

Miller, R. & Blair, P. (2009). *Input-output analysis. Foundations and extensions*. New York: Cambridge University Press.

Neef, A. & Thomas, J. (1988). *International comparison of productivity and ULC trends in manufacturing*. Monthly Labour Review, December.

Nübler, I. & Ernst, C. (2011). *Macroeconomic policy and labour market institutions. Infrastructure investment:*

Creating assets, employment and capabilities for development. Working note. Geneva: ILO.

O'Mahony, M. & Timmer, M. (2009). *Output, input and productivity measures at the industry level: The EU KLEMS database*. Economic Journal, 119 (538), F374-F403.

O'Connor, R. & Henry E. W. (1975). *Input-output and its applications*. London: Ch. Griffin.

Otto, D.M. & Johnson, T. G. (eds.) (1993). *Microcomputer base applications input-output modelling*. Boulder: Westview Press.

Round, J. (2003). Social accounting matrices and SAM-based multiplier analysis, in: Bourguignon, F.; da Silva, P. & Luiz, A. (eds.) *The impact of economic policies on poverty and income distribution: evaluation techniques and tools* (301-324). Washington DC: World Bank.

Saget, C. (2013). *Subsidios a la nómina y a las cotizaciones salariales: experiencias en los países del G20 en respuesta a la gran crisis internacional 2008-2009* [Subsidies on payroll and payroll taxes: experiences in the G20 countries in response to the great international crisis 2008-2009]. Buenos Aires: ILO.

Timmer, M. (ed.) (2012). The World Input-Output Database (WIOD): Contents, sources and methods in *Working Paper No. 10*. Brussels: European Commission.

Tschetter J. & Lukasiewicz, J. (1983). *Employment changes in construction: Secular, cyclical, and seasonal*. Monthly Labour Review, March.

Van Heemst, J.J. (1991). Introduction: the social accounting framework for development, in Alarcon J. et al. (eds.): *The Social Accounting Framework for Development: Concepts, construction, and applications* (1-31). Aldershot: Avebury.

World Bank (2010). *World Bank list of economies*. Washington DC: World Bank.

Appendix 1

DATA DETAILS BY COUNTRY

2009 by GNIpc	Country denomination		GDP current USD 1995 (%)	2009 (%)	Sector specification	Employment data description
HIC	AUS	Australia	1.24	1.59	34, w/o data for private HH w/ employees	Based on EU KLEMS. The employment to VA ratio of 2007 was applied to VA in 2008 and 2009. A constant skill-type ratio in overall employment was taken for 2006-2009 from 2005 (the latest data).
HIC	AUT	Austria	0.80	0.66	35	Based on STAN. Skill shares (in HW) were calculated from the LFS data for 2002-2009. The EU KLEMS' skill share growth was used to extrapolate the series backwards to 1995.
HIC	BEL	Belgium	0.95	0.81	35	Based on STAN. HW were available for employees taking their averages for persons engaged, w/ missing data for breakdowns of industries G, I and K. Skill shares were calculated from the LFS data for 2002-2009, extrapolating them backwards w/EU KLEMS' skill shares.
MIC (upper)	BRA	Brazil	2.58	2.79	34, w/o data for private HH w/ employees	Based on its NAS, employment refers to occupations, including informal and own-account workers. The PAC was used to split up distributive trade industries and the PAS to separate transportation services using shares from business services and personal and community services. HW, wage and employment shares by skill were derived by industry from the PNAD for 15 sectors to assure a representative sample. For sub-sectors, the parent industry values were imputed. The employment by educational attainement from PNAD was matched w/ISCED; relative wages from PNAD showed a gap about 4 -HS/LS-. Labour shares in VA were estimated by adding wage income of self-employed to labour compensation, combining them from IO data -1990 to 2003- w/the overall wage rate from SEDLAC. The wage income of own-account workers was added to the compensation data by sector, except for government administration, education, and health services where there are no imputation. As for agriculture and leather and footwear manufacturing (99% of workers were employees) and the imputation resulted in a labour share larger than VA, compensation data was used.
MIC (upper)	BGR	Bulgaria	0.04	0.08	34, w/o data for private HH w/ employees	Based on EUROSTAT. Breakdowns of industries G, I and K were based on VA share from SBS. Shares in 2008 and 2009 were set equal to 2007. Since there was no data on educational attainment, EU KLEMS' Portuguese skill-shares by industries were imputed.
HIC	CAN	Canada	1.98	2.30	35	Based on EU KLEMS. Compensation share from the IO table were used to split employment and labour compensation in texile, leather and all the transports.
MIC (lower)	CHN	China	2.44	8.59	33, w/o data for private HH w/ employees & sale, maintenance and repair of motor vehicles…	Based on the NBS: population censuses for 3 sector series as control totals, CIESY employment data for enterprises, CLSY data for total employment in manufacturing, 1985 and 1995 Industrial Censuses and 2004 and 2008 Economic Censuses for industry level data, splitting employment by educational attainment for 2004 -from LFS for the agriculture sector-. Educational attainment by industry was extrapolated using trends from the LFS for 2002-2008, 2009 shares were assumed similar to 2008. Prior to 2002, growth rates of primary (LS), secondary (MS), and tertiary (HS) were used, normalizing them to sum to 1. Relative wages were imputed by the urban CHIP survey -wide varieties of wage income definitions cross urban-rural areas- for 1995, 2002, and 2007 for 9 broad sectors, dropping the 1st and 99th percentile of wage income groups to correct outliers and interpolating missing years. Wage ratio HS/LS workers increased over time, rising from 1.41 in 1995 to 1.71 in 2007. Labour shares in VA were from labour compensation provided in the IO tables. Prior to 2004, self-employed income and their employees were included in labour compensation whereas profits related to owners (informal entrepreneurs) should have been part of gross operating surplus. After that, income GDP accounting method changed, breaking the labour share time series by industry: profits of state-owned and collective-owned farms were included in labour compensation, introducing an upward break in the agricultural labour shares; and income of self-employed owners was subsequently included in gross operating surplus. The former definition was reached for all the period after some adjustments. Estimates were reconciled w/the national totals.

Source: Authors' elaboration based on O'Mahony and Timmer (2009), World Bank (2010), Timmer (2012), ILO global wage database 2012 and World Bank indicators.

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DATA DETAILS BY COUNTRY

2009 by GNIpc	Country denomination		GDP current USD 1995 (%)	2009 (%)	Sector specification	Employment data description
HIC	CYP	Cyprus	0.03	0.04	35/34, w/o data for coke, refined petroleum and nuclear fuel between 05-09	Based on EUROSTAT. Prior to 2000, data was estimated based on VA growth rates and normalized on the aggregate totals of D, G, I and K. Skill shares were calculated from the LFS data for 2002-2009, extrapolating them backwards w/EU KLEMS' Portuguese skill shares. Relative wages in 2009 were set equal to 2008.
HIC	CZE	Czech Republic	0.19	0.34	35	Based on STAN. HW for 2009 were estimated as in 2008. Skill shares (in HW) and labour compensation were calculated from the LFS data for 2002-2009, extrapolating them backwards w/EU KLEMS' skill shares. Relative wages in 2009, available for 2002-2008 from SES and SILC, were assumed equal to 2008.
HIC	DNK	Denmark	0.61	0.53	35	Based on STAN. HW, missing for breakdowns of industries D, I and K in 2008 and 2009, was extrapolated w/aggregated industry growth by multiplying employment in persons. Skill shares (in HW) and labour compensation were calculated from the LFS data for 2002-2009, extrapolating them backwards w/EU KLEMS' skill shares. Relative wages in 2002-2003 and 2009, available for 2004-2008 from SES and SILC, were assumed equal to 2004 and 2008, respectively.
HIC	EST	Estonia	0.01	0.03	34, w/o data for private HH w/employees	Based on STAN. HW prior to 2000 were estimated by assuming them equal to 2000. The disaggregation of industry G took the shares of employees compensation. Skill shares were calculated from the LFS data for 2002-2009, extrapolating them backwards w/EU KLEMS' Portuguese skill shares. Relative wages in 2009, available for 2002-2008 from SES and SILC, were assumed equal to 2008.
HIC	FIN	Finland	0.44	0.41	35	Based on STAN. HW for 2009 were estimated as in 2008. Skill shares (in HW) and labour compensation were calculated from the LFS data for 2002-2009, extrapolating them backwards w/EU KLEMS' skill shares. Relative wages in 2009, available for 2002-2008 from SES and SILC, were assumed equal to 2008.
HIC	FRA	France	5.27	4.51	35	Based on EUROSTAT. Average HW from EU KLEMS were multiplied by the EUROSTAT employment data and updated to 2009 using the growth trend aggregates at 6 branchs from EUROSTAT. Growth trends of lower level industries were updated w/the growth trend of the parent industry. Skill shares (in HW) and labour compensation were calculated from the LFS data for 2002-2009, extrapolating them backwards w/EU KLEMS' skill shares. Relative wages in 2009, available for 2002-2008 from SES and SILC, were assumed equal to 2008.
HIC	DEU	Germany	8.46	5.68	35	Based on STAN. HW, missing for breakdowns of industries G, I and K, were available for manufacturing since 2002 and extrapolated backwards w/average HW growth by applying it to the level of average HW in 2002 for those industries. Since 2009 data was just for aggregated industries, their growth rate was used to estimate their breakdowns. Skill shares (in HW) and labour compensation were calculated from the LFS data for 2002-2009, extrapolating them backwards w/EU KLEMS' skill shares. Relative wages in 2009, available for 1998-2008 from SES and SILC, were assumed equal to 2008.
HIC	GRC	Greece	0.44	0.55	35	Based on STAN. HW were estimated for 1995-2000 by assuming a fixed ratio of employees to self-employed. Skill shares (in HW) and labour compensation were calculated from the LFS data for 2002-2009, extrapolating them backwards w/EU KLEMS' skill shares. Relative wages in 2009, available for 2002-2008 from SES and SILC, were assumed equal to 2008.
HIC	HUN	Hungary	0.15	0.22	34, w/o data for private HH w/ employees	Based on STAN. Employees HW were incomplete; but data for aggregate industries was available for the whole period, each split were estimated w/the average number of HW for the whole industry. HW for total persons engaged were missing detail prior to 2000 and after 2007. The distribution was kept constant at the 2000 or 2007 level. Skill shares (in HW) and labour compensation were calculated from the LFS data for 2002-2009, extrapolating them backwards w/EU KLEMS' skill shares. Relative wages in 2009, available for 2002-2008 from SES and SILC, were assumed equal to 2008.

Source: Authors' elaboration based on O'Mahony and Timmer (2009), World Bank (2010), Timmer (2012), ILO global wage database 2012 and World Bank indicators.

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DATA DETAILS BY COUNTRY

2009 by GNIpc	Country denomination		GDP current USD 1995 (%)	2009 (%)	Sector specification	Employment data description
MIC (lower)	IND	India	1.23	2.35	34, there is no interaction w/public administration despite that there is sectoral data, so it was taken as an exogenous sector	Based on NSSO. ASI provided annual employment data for registered manufacturing, DGET for all registered segments of the economy and NSSO provided annual employment data from a smaller sample of HH, calculating unorganized employment for survey years as a residual and interpolating linearly it to organized employment in order to generate time-series in the unorganized sector. The sum of the two for the years in-between the survey years was the total employment. Assuming that wage rate grows linearly between two consecutive survey years, the annual wage rate was imputed. Breakdowns shares came from NSSO. Self-employed wages were imputed w/a Mincer wage equation. Employee compensation for broad sectors was taken from NAS, the ASI -annually- was used to get manufacturing distribution of the organized sector and the NSSO survey (1989-90, 1994-95, 2000-01 and 2005-06) to get unit level data on unorganized manufacturing sector, interpolating the distribution linearly in between. For trade and other services, VA distribution was used to split aggregates. Relative wage rate of self-employed to employees was computed from NSSO. Self-employed compensation was then estimated using the calculated wage rate. When estimated compensation was higher than the reported mixed income the entire mixed income was considered as self-employed compensation. The sum of compensation from NAS and the estimated self-employed compensation was taken as total compensation. HW were computed using information on average number of days worked per week from NSSO, assuming 8 hours of work per day and 52 working weeks in a year.
MIC (lower)	IDN	Indonesia	0.68	0.93	33, w/o data for private HH w/ employees & sale, maintenance and repair of motor vehicles…	Based on IO tables, interpolated using the growth rate of employment in the parent industry, obtained from GGDC 10 sector database. After 2005, employment figures were extrapolated using growth rates from ILO until 2008 and from BPO, National LFS for 2008 and 2009, assuming the same growth rate as in the parent industries. The number of self-employed came from ILO data for 1992, 1997-1998 and 2000-2008 for 9 sectors, being them interpolated in-between. This estimation was subtracted from total persons engaged to obtain total employees. Total compensation was taken from NAS, using shares from IO tables for industry distribution, interpolating industry shares and assuming it as a constant after 2005. India's relative wage rate of self-employed to employees was imputed for self-employed compensation Employees skill shares and compensation were taken from 'Laborer/Employee situation in Indonesia', and 'Labor force situation in Indonesia' of Badan Pusat Statistik.
HIC	IRL	Ireland	0.23	0.39	35	Based on STAN. EU KLEMS for average HW, using the growth trend of average HW from the aggregates at the 6 branch level from EUROSTAT. Growth trends of lower level industries were updated w/the growth trend of the parent industry. VA shares from EU KLEMS were used for sector I disaggregation. The ratio of the total number of persons engaged over employees in 1998 was used to estimate values prior to 1998 for employees. The distribution of employment compensation was used to estimate data for the breakdown of industries G and K. Skill shares (in HW) and labour compensation were calculated from the LFS data for 2002-2009, extrapolating them backwards w/EU KLEMS' skill shares. Relative wages in 2002-2003 and 2009, available for 2004-2008 from SES and SILC, were assumed equal to 2004 and 2008 levels, respectively.
HIC	ITA	Italy	3.80	3.63	35	Based on STAN. Industry average HW were used to estimate HW breakdowns for G, I and K. Skill shares (in HW) and labour compensation were calculated from the LFS data for 1998-2009, extrapolating them backwards w/EU KLEMS' skill shares. Relative wages in 2009, available for 1998-2008 from SES and SILC, were assumed equal to 2008.
HIC	JPN	Japan	17.89	8.67	34, w/o data for private HH w/ employees	Based on EU KLEMS. To update the employment series, a constant employment to VA ratio from 2007 for 2008-2009 whereas, for employment and labour compensation by skill type, a constant ratio from 2005 for 2006-2009 . For employment and labour compensation by skill type.

Source: Authors' elaboration based on O'Mahony and Timmer (2009), World Bank (2010), Timmer (2012), ILO global wage database 2012 and World Bank indicators.

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DATA DETAILS BY COUNTRY

2009 by GNIpc	Country denomination		GDP current USD 1995 (%)	GDP current USD 2009 (%)	Sector specification	Employment data description
HIC	KOR	Korea. Rep.	1.73	1.44	34, there is no interaction 34, w/o data for private HH w/ employees	Based on EU KLEMS. 2007 sectoral shares were applied to total employment in 2008-2009, imputed using growth rates obtained from OECD. Skill shares for 2008-2009 were assumed to be the same as in 2007.
HIC	LVA	Latvia	0.02	0.04	35/34, w/o data for coke, refined petroleum and nuclear fuel in 2001, 2008-2009	Based on EUROSTAT. VA share from EU KLEMS were used to split industry I and its average HW were multiplied by the EUROSTAT employment data, updated to 2009 using the growth trend aggregates at the 6 branch level from EUROSTAT. They served to update growth trends of lower level industries. Skill shares were calculated from the LFS data for 2002-2009, extrapolating them backwards w/EU KLEMS' Portuguese skill shares. Relative wages in 2009, available for 2002-2008 from SES and SILC, were assumed equal to 2008.
MIC (upper)	LTU	Lithuania	0.03	0.06	35/34, w/o data for private HH w/ employees between 1995-1996	Based on EUROSTAT. Missing data for breakdowns of G, I and K; HW were estimated as equal to those from the aggregates. Skill shares were calculated from the LFS data for 2002-2009, extrapolating them backwards w/EU KLEMS' Portuguese skill shares. Relative wages in 2009, available for 2002-2008 from SES and SILC, were assumed equal to 2008.
HIC	LUX	Luxembourg	0.07	0.09	33, w/o data for leather and footwear & coke, refined petroleum and nuclear fuel	Based on STAN. Average HW were taken from EU KLEMS and those for 2008-2009 were set equal to 2007. Skill shares (in HW) and labour compensation were calculated from the LFS data for 2002-2009, extrapolating them backwards w/EU KLEMS' skill shares. Relative wages in 2009, available for 2002-2008 from SES and SILC, were assumed equal to 2008.
HIC	MLT	Malta	0.01	0.01	35/34, w/o data for coke, refined petroleum and nuclear fuel in 2005	Based on EUROSTAT. at the 6 branch level for 2002-2009. Breakdowns by industries were estimated w/VA share. Employees' data was available for 2000-2009, only total economy values, using the distribution of total persons engaged for detailed variables. HW were available for 1995-2000, using the growth rate of total HW to extrapolate data for employees and persons engaged backwards to 1995. The breakdown of HWwas based on the distribution of total persons engaged. HW by employees were estimated by multiplying the average HW by persons engaged by the total number of employees in each industry. Portuguese skill-shares were imputed.
MIC (upper)	MEX	Mexico	0.96	1.52	35	Based on its NAS. According to the INEGI, the number of jobs is a measure of employment taking additional jobs by a person into account. Prior to 2003, growth rates backwards extrapotalion from the previous series in the CBS took place. The split of employment by educational attainment -number of years studied- was based on the ENE for 1995-2004 and the ENOE later on to derive the number of years of education for each skill-type according to the ISCED, relative wages were obtained from them. Labour shares in VA were estimated by adding the wage income of self-employed to labour compensation, combining them by industry w/the economy-wide average wage rate from SEDLAC. The wage income of own-account workers was added to the compensation data by sector, except for government administration, education, and health services where there are no imputation.
HIC	NLD	Netherlands	1.41	1.37	35	Based on STAN. Prior to 2001, HW data was estimated according to total persons engaged growth rates of each industry and normalized to match totals of D, G, I and K. Skill shares were calculated from the LFS data for 2002-2009, extrapolating them backwards w/EU KLEMS' skill shares. Relative wages in 2009, available for 2002-2008 from SES and SILC, were assumed equal to 2008.

Source: Authors' elaboration based on O'Mahony and Timmer (2009), World Bank (2010), Timmer (2012), ILO global wage database 2012 and World Bank indicators.

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DATA DETAILS BY COUNTRY

2009 by GNIpc	Country denomination		GDP current USD 1995 (%)	2009 (%)	Sector specification	Employment data description
HIC	POL	Poland	0.47	0.74	35	Based on EUROSTAT. Breakdowns of industries G and K were based on VA share from EU KLEMS. From 2006 onwards (and from 1999 backwards for employment) industry detail was missing. Since 1995-1998 rare outcomes were observed, labour compensation by sector was done, based on ILO wage database and taking persons engaged shares according to those from de VA. Growth patterns of the aggregate industries were used to estimate data for the detailed industries. Average HW from EU KLEMS were multiplied by the EUROSTAT employment data and updated to 2009 using the growth trend aggregates at the 30 branch level from EUROSTAT. Growth trends of lower level industries were updated w/the growth trend of the parent industry. Skill shares (in HW) and labour compensation were calculated from the LFS data for 2002-2009, extrapolating them backwards w/EU KLEMS' skill shares. Relative wages in 2009, available for 2002-2008 from SES and SILC, were assumed equal to 2008.
HIC	PRT	Portugal	0.39	0.40	35	Based on EUROSTAT. Breakdowns of industries G, I and K were estimated w/VA share from EU KLEMS, which were assumed constant after 2006. Growth patterns of the aggregate industries were used to estimate data for the detailed industries. Average HW from EU KLEMS were multiplied by the EUROSTAT employment data and updated to 2009 using the growth trend aggregates at the 6 branch level from that. Growth trends of lower level industries were updated w/the growth trend of the parent industry. Skill shares (in HW) and labour compensation were calculated from the LFS data for 2002-2009, extrapolating them backwards w/EU KLEMS' skill shares. Relative wages in 2009, available for 2002-2008 from SES and SILC, were assumed equal to 2008.
MIC (upper)	ROU	Romania	0.12	0.28	34, w/o data for private HH w/ employees	Based on EUROSTAT. Since data for 2009 was only available for aggregates; inter-industry estimates were made by using the growth rates of the aggregate industries. HW estimation prior to 1999 were base on ILO data -growth of average HW- at the aggregate level, which was applied to each sector in combination w/employment data in persons. EU KLEMS' Portuguese skill shares were imputed.
MIC (upper)	RUS	Russian Federation	1.33	2.11	34, w/o data for private HH w/ employees	Based on its NAS. Employment series provided full-time equivalent jobs by one-digit sectors for 2003-2008, including HH that produce goods and services for own consumption. HW share of HH producers was estimated at about 12-15% of total HW, and 57.8% was imputed to agriculture (Rosstat, 2009). For disaggregation and backward extrapolation of employment series, the balance of LF, the full circle employment survey and the LFS were used for particular industries. Skill-type shares were assumed similar to that of the Czech Republic.
HIC	SVK	Slovak Republic	0.08	0.15	34, w/o data for private HH w/ employees	Based on STAN. Skill shares (in HW) and labour compensation were calculated from the LFS data for 2002-2009, extrapolating them backwards w/EU KLEMS' skill shares.
HIC	SVN	Slovenia	0.07	0.08	35	Based on STAN. EU KLEMS for average HW until 2006, when it was assumed constant later on. Skill shares (in HW) and labour compensation were calculated from the LFS data for 2002-2009, extrapolating them backwards w/EU KLEMS' skill shares. Relative wages in 2002-2004 and 2009, available for 2005-2008 from SES and SILC, were assumed equal to 2005 and 2008, respectively.
HIC	ESP	Spain	2.00	2.51	34, w/o data for private HH w/ employees	Based on STAN. Prior to 2000, HW data was estimated by applying the growth rate of average HW from the aggregates and multiplied by employment in persons which was available. The values of interindustry HW details were normalized to sum to the industry aggregates. Skill shares were calculated from the LFS data for 2002-2009, extrapolating them backwards w/EU KLEMS' skill shares. Relative wages in 2009, available for 2002-2008 from SES and SILC, were assumed equal to 2008.

Source: Authors' elaboration based on O'Mahony and Timmer (2009), World Bank (2010), Timmer (2012), ILO global wage database 2012 and World Bank indicators.

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DATA DETAILS BY COUNTRY

2009 by GNIpc	Country denomination		GDP current USD 1995 (%)	GDP current USD 2009 (%)	Sector specification	Employment data description
HIC	SWE	Sweden	0.85	0.70	35/34, w/o data for leather and footwear in 2009	Based on STAN. Employment data for detailed industry G was estimated by applying the shares from employees' compensation. Skill shares were calculated from the LFS data for 2002-2009, extrapolating them backwards w/EU KLEMS' skill shares. Relative wages in 2009, available for 2002-2008 from SES and SILC, were assumed equal to 2008.
HIC (2008)	TWN	Taiwan	NA	NA	35	Based on DGBAS for 2000-2010, extrapolating it backwards using previous versions. Distribution from detailed pay-roll statistics was used to split total manufacturing, labor compensation shares were used to split some of the service. To compute total workers, the number of self-employed was obtained along w/total workers for years 1993, 2002, 2007 and 2009, applying ratios of self-employed to employees for 14 industry level and using the ratios of parent industries and those linearly interpolated for years in-between. Employees' compensation/GDP -IO tables & NAS- by sector was used to compute total compensation and normalized to the NAS total. Total compensation was computed by multiplying relative wage rate of self-employed/employees w/the ratio of self-employed/employees to obtain the ratio of self-employed compensation to employee compensation, assuming the same rates for nearest sub-sectors based on Census of Industry, 2006. On average self-employed income was about 65% of employee income and appeared to be rather stable over time, so it was keept constant. HW by employees were derived by multiplying number of employees w/average annual HW per employee, which were based on average monthly/weekly HW by number of employees. Annual data was taken from Earnings and productivity survey and Reports on the Manpower Utilization Survey 2004-2007, using the same rates as 2004 and 2007 to extrapolate it backwards and forwards. HW by self-employed were assumed to be the same as for employees for each industry. Skill shares (1993, 2002, 2004-2009, 14 sectors) were interpolated in-between and assumed as the same as the nearest aggregate sector to split them. Labour compensation by skill from Report on the Manpower Utilization Survey was imputed by each sector for 2004-2009, extrapolating backwards as in 2004.
MIC (upper)	TUR	Turkey	0.57	1.06	35	Based on theTurkstat LFS and the annual business enterprise survey to split it into subsectors for 1992-2001, separately for firms employing 1-9 and 10+ workers for manufacturing sector. It was also obtained for services since 2003. The LFS provided agricultural sector data since 2002, before the business survey was used to split it. Self-employed by industries were imputed by using the ratio of self-employed to total persons from business statistics multiplied w/total persons from LFS. The distribution of this series has been applied to the total reported self-employed in non-agricultural sector to obtain sectoral self-employed workers. Employees' compensation/GDP -IO tables & NAS- by sector was used to compute total compensation, applying relative wage rates of self-employed/employees in India for self-employed. Since this imputation produced very high compensation for agriculture, total compensation share in GDP for agriculture was set as 0.9. Aggegates skill-type shares were assumed for subsectors and their compensation was based on average earnings for education categories for the aggregate economy for 2006 and 2010 and their secotoral relative wages. Before 2006, a fixed relative wage rate was used. HW were based on HW per employee at aggregate level from the total economy database assuming same HW for all industries, in order to impute them in each industry.
HIC	GBR	United Kingdom	3.93	3.76	35	Based on EUROSTAT, at the 6 branch level. Employees' compensation was used to descompose them. Breakdowns of industries G, I and K were estimated w/shares from EU KLEMS, which were assumed constant after 2006. Employment shares were used to distribute HW -aggregates for total persons engaged- over detailed industries. Skill shares (in HW) and labour compensation were calculated from the LFS data for 2005-2009, extrapolating them backwards w/EU KLEMS' skill shares. Relative wages were available for 2005-2009 from SES and SILC.

Source: Authors' elaboration based on O'Mahony and Timmer (2009), World Bank (2010), Timmer (2012), ILO global wage database 2012 and World Bank indicators.

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DATA DETAILS BY COUNTRY

2009 by GNIpc	Country denomination		GDP current USD 1995 (%)	GDP current USD 2009 (%)	Sector specification	Employment data description
HIC	USA	United States	24,62	23,93	35	Bases on EU KLEMS. Labour compensation was imputed by assuming the employees' wage rate for self-employed. For skill shares, in few manufacturing sectors and transport, the same skill distribution as in the parent industry. The same applies for both employment and compensation shares.
	Wiod countries / World		**88.13**	**85.38**		
MIC (lower)	MAR	Morocco	0.11	0.16	25 sectors, excluding re-exports and re-imports from MRIO. EORA database under a common industry and commodity classification	Based on its LFS for 2002-2009. As it was split into 7 branchs, employment shares by industry were assumed by imputing their VA shares in the aggregate parent sector. Labour compensation was taken from the EORA by adding the net mixed income to employees' compensation. HW were not available in order to make comparable with WIOD.
LIC	NER	Niger	0.01	0.01		Based on its statistical yearbook, chapter employment, income and wages for 2006-2009. Figures were expanded to the whole population w/World Bank data. Since it was split up in 9 broad sectors, employment shares by industry were assumed by imputing their VA shares in the aggregate parent sector. Labour compensation was taken from the EORA by adding the net mixed income to employees' compensation. HW were not available in order to make comparable with WIOD.
MIC (lower)	PAK	Pakistan	0.20	0.28		Based on LFS for 1999-2009 w/outcomes for 2 years-time, which priveded employment shares for 9 aggregate sectors. To split them, intra-industry employment share was assumed by imputing their VA shares in the aggregate parent sector. World Bank data was taken for employment figures at national level. Labour compensation was taken from the EORA by adding 50% of the mixed income to employees' compensation. HW were not available in order to make comparable with WIOD
MIC (lower)	PRY	Paraguay	0.03	0.03		Based on its annual household survey for 2006-2009. Figures were expanded to the whole population and represents occupied people, excluding employeers. Since it was split in 8 broad sectors, employment shares by industry were assumed by adding their output shares in the aggregate parent sector. Labour compensation was taken from the EORA by adding the mixed income to employees' compensation. HW were not available in order to make comparable with WIOD.
MIC (upper)	ZAF	South Africa	0.51	0.49		Based on its annual household survey for 2009. Figures were expanded to the whole population using WB data and represents occupied people. Since it was split in 8 broad sectors, employment shares by industry were assumed by adding their output shares in the aggregate parent sector. Labour compensation was taken from the EORA by adding the mixed income to employees' compensation.
MIC (lower)	LKA	Sri Lanka	0.04	0.07		Based on its annual LFS for 2000, 2002, 2004, 2006-2009. Since it excluded the Northen province, World Bank data was taken for employment figures at national level. As it was split in 13 industry groups, employment shares by industry were assumed by imputing employment shares from the annual employment survey to sstablishments -for 1995-1996 and 1998-2007- which was provided information for 30 industries and became the base to extrapolate the series backwards. It was also consisted w/their VA shares in the aggregate parent sector. Labour compensation was taken from the EORA by adding the net mixed income to employees' compensation. HW were not available in order to make comparable with WIOD.
Selected countries from EORA / World			**0,70**	**0,75**		
World GDP (billions of USD)			**29.810**	**58.080**		

Source: Authors' elaboration based on O'Mahony and Timmer (2009), World Bank (2010), Timmer (2012), ILO global wage database 2012 and World Bank indicators.

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Appendix 2

SIZE OF THE CONSTRUCTION SECTOR BY COUNTRY, MULTIPLIER EFFECTS AND AVERAGE HOURS WORKED BY COUNTRY IN 1995 AND 2009

	Share of the construction sector (%)											
	Output			Intermediate inputs			Value added			Labour compensation		
Country	1995		2009	1995		2009	1995		2009	1995		2009
Australia	9.8	↑	12.4	13.1	↑	16.9	6.0	↑	7.5	7.5	↑	9.2
Austria	8.5	↓	8.1	9.3	↓	8.8	7.9	↓	7.3	7.8	↓	6.9
Belgium	6.9	↑	7.8	8.4	↑	9.6	5.1	↑	5.4	5.8	↓	5.4
Brazil	5.7	↓	5.2	5.9	↓	5.2	5.5	↓	5.3	4.1	↑	6.2
Bulgaria	4.5	↑	12.0	4.2	↑	13.7	4.8	↑	9.1	6.1	↑	6.7
Canada	6.5	↑	7.9	8.3	↑	9.9	4.9	↑	6.1	6.9	↑	8.0
China	8.1	↑	9.4	9.4	↑	10.7	6.1	↑	6.6	7.8	↑	8.0
Cyprus	9.7	↑	10.4	11.9	↑	13.3	8.3	↓	8.2	10.2	↓	8.4
Czech Republic	9.7	↓	9.1	11.6	↓	10.2	6.6	↑	7.4	10.9	↓	8.5
Denmark	6.8	↓	6.5	9.2	↓	8.0	4.7	↑	4.9	6.7	↓	6.6
Estonia	7.9	↑	8.3	8.7	↑	9.4	6.7	↑	7.0	6.7	↑	8.6
Finland	6.1	↑	8.2	7.2	↑	9.2	4.8	↑	7.0	6.9	↑	9.0
France	6.6	↑	7.4	7.5	↑	8.3	5.7	↑	6.4	6.3	↑	6.5
Germany	7.8	↓	5.1	8.9	↓	6.0	6.8	↓	4.3	8.0	↓	5.1
Greece	8.9	↓	6.8	12.5	↓	10.4	6.0	↓	4.5	4.9	↓	4.5
Hungary	4.9	↓	4.8	5.2	↓	5.2	4.4	↓	4.4	5.0	↓	4.6
India	6.5	↑	11.6	7.9	↑	15.1	5.1	↑	8.2	7.2	↑	12.3
Indonesia	10.3	↑	14.0	14.1	↑	18.2	6.8	↑	9.9	7.7	↑	8.6
Ireland	7.3	↓	6.9	8.9	↓	7.8	5.3	↑	5.6	8.8	↑	11.3
Italy	6.5	↑	6.7	7.6	↓	7.0	5.3	↑	6.3	5.8	↑	6.9
Japan	9.6	↓	7.0	11.2	↓	7.9	8.2	↓	6.2	11.4	↓	9.1
Korea	9.9	↓	6.9	9.8	↓	6.8	10.1	↓	6.9	11.7	↓	8.7
Latvia	5.6	↑	11.8	6.5	↑	16.3	4.6	↑	6.6	5.4	↑	8.5
Lithuania	6.8	↓	4.9	7.1	↓	4.6	6.5	↓	5.3	8.4	↓	7.8
Luxembourg	6.8	↓	4.9	7.1	↓	4.6	6.5	↓	5.3	8.4	↓	7.8
Malta	5.0	↓	4.4	5.0	↓	4.8	4.9	↓	3.9	4.9	↓	3.8
Mexico	5.7	↑	8.3	7.0	↑	10.1	4.7	↑	7.0	6.6	↑	8.9
Netherlands	7.4	↑	7.6	9.3	↓	9.0	5.4	↑	6.0	6.9	↑	7.3
Poland	7.5	↑	9.2	8.2	↑	10.8	6.7	↑	7.3	6.4	↑	6.4
Portugal	8.9	↓	8.7	11.2	↓	11.1	6.4	↓	6.1	7.2	↑	7.7
Romania	6.0	↑	6.6	5.9	↑	7.7	6.0	↓	5.5	9.7	↓	7.1
Russia	6.0	↑	6.6	5.9	↑	7.7	6.0	↓	5.5	9.7	↓	7.1
Slovak Republic	7.0	↑	9.7	8.2	↑	9.9	5.1	↑	9.5	7.5	↑	8.7
Slovenia	8.2	↑	11.4	10.0	↑	14.3	6.0	↑	7.9	5.1	↑	7.3
Spain	10.4	↑	14.6	13.2	↑	18.0	7.5	↑	10.8	8.5	↑	11.0
Sweden	5.2	↑	5.6	5.7	↑	6.0	4.6	↑	5.2	5.9	↑	6.9
Taiwan	7.0	↓	4.2	8.7	↓	5.8	4.9	↓	2.2	6.8	↓	3.4
Turkey	7.0	↓	4.8	8.8	↓	5.3	5.6	↓	4.2	2.5	↑	3.1
United Kingdom	6.9	↑	7.4	8.9	↑	9.0	5.0	↑	5.8	6.7	↑	7.9
United States	5.1	↓	4.7	6.3	↓	5.5	4.2	↓	4.0	6.0	↑	6.1

Note: Data for 2009 was preliminary, so data for 2008 related to employment multipliers was included due to the fact that some changes were observed.
Source: Authors' calculations based on data from WIOD.

Appendix 2

SIZE OF THE CONSTRUCTION SECTOR BY COUNTRY, MULTIPLIER EFFECTS AND AVERAGE HOURS WORKED BY COUNTRY IN 1995 AND 2009 *(Continuación)*

Output	Overall level total multiplier effects					Construction sector - total multiplier effects total multiplier effects					Hours worked weekly average	
	Employment		Output			Employment		Hours worked				
	1995	2009	1995	2008	2009	1995	2009	1995	2008	2009	1995	2009
Australia	4.4	4.3	34.5	17.2	18.6	4.6	4.8	35.1	18.0	19.4	35.4	34.5
Austria	3.7	3.3	22.6	11.6	13.1	3.7	3.3	21.2	10.5	11.7	31.8	30.4
Belgium	2.9	2.9	12.8	7.5	8.5	3.2	3.2	11.8	6.4	7.4	27.5	27.3
Brazil	3.6	4.4	184.2	113.8	126.6	3.3	4.9	182.3	142.4	162.3	41.2	40.8
Bulgaria	3.2	2.9	277.8	62.1	72.4	3.4	2.9	283.2	46.7	55.4	32.9	31.8
Canada	3.2	3.4	34.6	16.8	17.9	3.5	3.6	33.7	16.7	17.6	34.2	32.7
China	4.7	3.8	1421.2	228.2	222.4	5.4	4.2	1408.1	207.5	198.6	34.3	38.4
Cyprus	2.8	3.2	42.8	23.2	26.4	3.1	3.9	42.8	27.4	30.4	36.2	35.3
Czech Republic	2.8	3.3	96.0	25.9	31.2	3.3	3.9	114.1	32.9	38.5	38.8	37.7
Denmark	3.2	3.4	15.8	9.1	10.8	3.6	3.8	16.7	9.8	11.6	29.7	30.0
Estonia	2.8	3.0	181.2	28.0	32.5	2.6	3.1	136.8	32.5	36.2	37.4	34.0
Finland	3.8	3.7	23.6	11.4	13.3	4.3	4.2	26.0	12.1	14.4	34.2	32.1
France	4.1	4.0	20.3	10.6	12.1	4.3	4.1	21.7	11.1	12.7	30.0	28.5
Germany	4.4	3.7	22.6	12.3	14.4	4.5	3.8	23.1	13.6	15.1	29.5	26.7
Greece	3.3	3.4	55.3	23.8	26.5	3.1	3.4	45.6	25.3	28.4	40.8	39.1
Hungary	3.5	2.8	122.8	29.9	36.4	3.6	2.7	130.8	35.9	42.9	38.6	37.8
India	4.1	3.4	1925.3	677.3	686.5	4.6	3.9	2065.9	614.6	646.7	44.6	45.1
Indonesia	3.4	3.5	418.9	217.2	210.9	3.7	3.3	391.1	158.4	157.5	27.9	26.6
Ireland	3.0	2.8	29.0	9.7	10.7	3.4	3.7	27.5	11.7	12.9	38.1	34.3
Italy	5.2	4.3	40.4	17.3	19.6	5.6	4.6	41.2	18.2	20.7	35.7	34.1
Japan	4.8	4.3	25.0	20.2	19.2	5.5	4.8	29.1	23.9	23.3	36.9	35.0
Korea	5.8	4.4	111.4	46.3	56.2	6.4	4.8	118.0	47.8	57.4	48.2	43.9
Latvia	2.8	3.2	181.1	31.5	36.8	2.9	3.4	169.7	28.7	30.9	30.0	28.2
Lithuania	2.5	2.6	204.8	35.3	43.3	2.6	2.8	201.2	37.2	53.5	31.0	31.3
Luxembourg	2.1	2.2	11.6	5.5	6.5	2.2	2.0	10.7	3.3	4.2	31.0	31.3
Malta	2.1	2.4	35.5	16.4	18.8	2.3	2.4	47.0	21.5	23.9	37.7	35.2
Mexico	2.6	2.4	177.8	79.3	97.3	2.7	2.5	163.7	68.2	84.4	41.9	41.1
Netherlands	3.1	3.1	17.1	8.7	9.7	3.5	3.5	17.9	9.2	10.3	28.1	26.5
Poland	4.7	3.3	198.5	35.8	43.8	4.6	3.2	178.7	31.4	40.1	36.9	34.0
Portugal	3.6	3.7	59.5	27.3	31.9	4.0	4.3	68.2	32.0	38.8	36.9	35.4
Romania	3.9	3.6	331.7	62.7	76.8	3.6	3.1	278.7	47.8	62.3	37.8	37.4
Russia	3.8	4.0	369.6	85.8	114.9	4.7	4.4	453.0	86.4	120.6	37.8	37.4
Slovak Republic	2.5	2.3	98.5	18.9	20.4	3.0	2.6	110.0	18.6	21.2	36.1	32.6
Slovenia	4.1	3.5	65.0	20.1	25.2	3.9	3.6	59.3	18.8	24.8	35.8	34.8
Spain	4.3	3.8	33.4	14.9	16.3	4.8	4.4	37.9	17.2	17.2	33.3	31.8
Sweden	3.4	3.3	19.2	9.4	12.6	3.7	3.5	21.2	11.3	14.9	31.5	30.8
Taiwan	3.6	3.3	61.4	38.3	42.3	4.1	3.6	71.6	44.6	51.3	44.4	40.7
Turkey	2.5	2.7	103.8	31.8	39.8	2.3	2.5	89.8	29.8	41.8	39.9	36.2
United Kingdom	4.1	4.1	33.1	14.2	18.0	4.8	4.9	38.1	16.2	20.7	31.0	29.6
United States	4.7	4.3	32.7	17.1	17.7	5.3	5.0	37.8	20.4	21.0	34.8	34.3

Note: Data for 2009 was preliminary, so data for 2008 related to employment multipliers was included due to the fact that some changes were observed.
Source: Authors' calculations based on data from WIOD.

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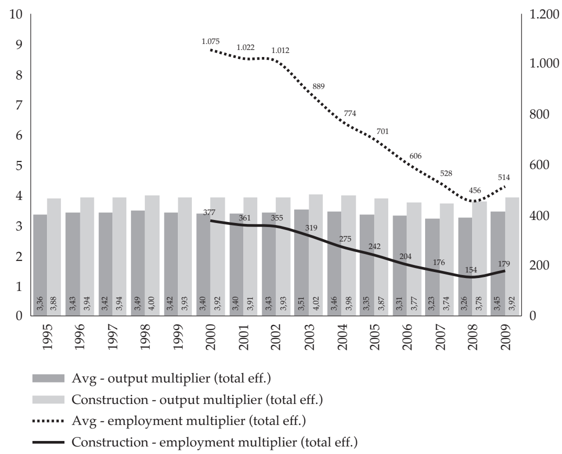
Appendix 3

SIZE OF THE CONSTRUCTION SECTOR AND MULTIPLIER EFFECTS IN LIC AND LMIC (EORA)

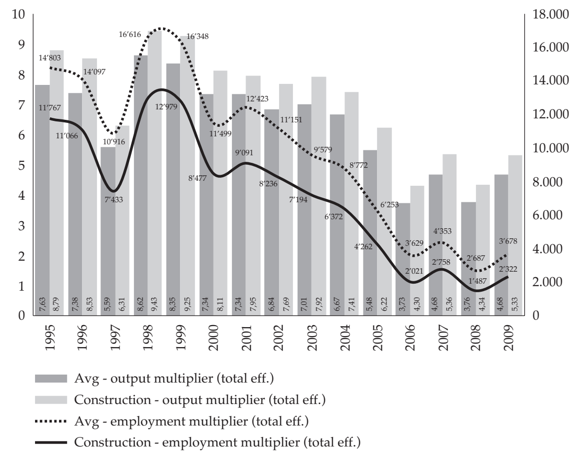
	Share of the construction sector (%)											
	Output			Intermediate inputs			Value added			Labour compensation		
Country	**1995**		**2009**	**1995**		**2009**	**1995**		**2009**	**1995**		**2009**
Morocco	6,4	↑	6,2	7,8	↓	7,4	5,0	↓	5,0	7,0	↓	6,9
Niger	5,0	↑	5,1	6,8	↓	6,3	3,5	↑	3,6	3,6	↑	3,7
Paraguay	6,3	↑	6,4	6,2	↑	6,4	6,6	↑	6,6	8,6	↓	8,5
Sri Lanka	6,1	↑	6,2	6,4	↑	6,6	5,9	↑	6,0	7,5	↑	7,6
South Africa	4,5	↑	4,5	6,1	↓	5,8	2,7	↑	3,3	3,3	↑	3,8

Source: Authors' calculations based on data from EORA.

Morocco: total effects on gross output and employment



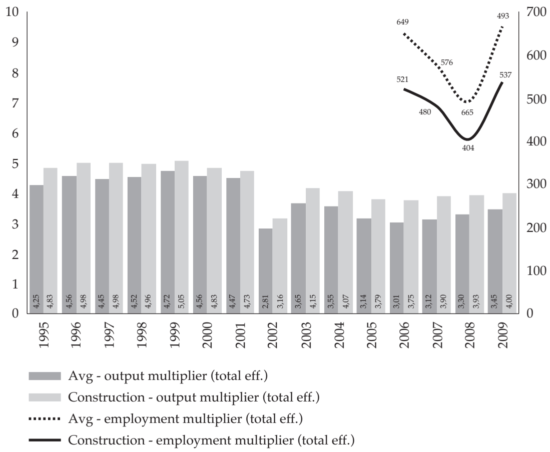
Niger: Total effects on gross output and employment



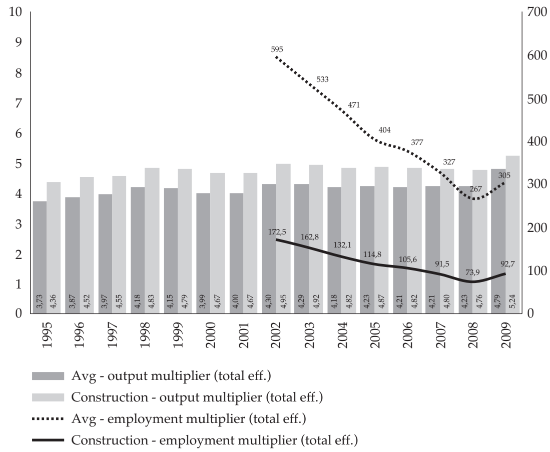
Source: Authors' calculations based on data from EORA.

Appendix 3
SIZE OF THE CONSTRUCTION SECTOR AND MULTIPLIER EFFECTS IN LIC AND LMIC (EORA)

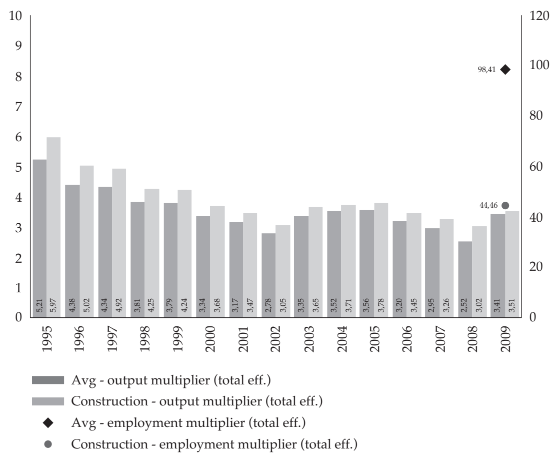
Paraguay: Total effects on gross output and employment



Sri Lanka: total effects on gross output and employment



South Africa: total effects on gross output and employment



Source: Authors' calculations based on data from EORA.

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Appendix 4

EMPLOYMENT IN THE CONSTRUCTION SECTOR VERSUS AT OVERALL LEVEL ACROSS TIME

The ***first group*** comprises 19 (out of 40) countries that had total employment multiplier effects in the construction sector higher than those at overall level during the whole period (next table). In other words, every additional dollar spent in the construction sector would tend to generate more new jobs than in the whole economy, on average, because of its particular backwards linkages. All of them were HIC, mainly from northern and continental Europe and other OECD members such as Australia, Japan, Korea and the USA. In addition, Malta, Russia and Taiwan complete this group.

The ***second group*** is made up of nine countries that systematically had total employment multiplier effects in the construction sector lower than those at overall level during the whole period (next table). On the opposite side of the former group, every additional dollar would be inclined to have a weaker potential to generate jobs if it were spent on the construction sector when compared with the national average. It is integrated by both income groups: HIC such as Austria, Belgium, Canada and Slovenia and MIC such as Indonesia, Latvia, Mexico, Poland and Romania.

Table 1

Total employment multipliers in construction are higher than at overall leve

Country	1995	Avg 1996-2008	Difference	2009
Australia	35.1	30.4	1.3	19.4
Czech Republic	114.1	84.6	12.7	38.5
Denmark	16.7	16.3	0.7	11.6
Finland	26.0	23.2	2.1	14.4
France	21.7	19.9	1.6	12.7
Germany	23.1	23.4	1.9	15.1
Hungary	130.8	84.6	6.0	42.9
Italy	41.2	30.2	1.1	20.7
Japan	29.1	31.5	5.1	23.3
Korea	118.0	95.9	4.7	57.4
Malta	47.0	41.9	11.3	23.9
Netherlands	17.9	17.3	1.6	10.3
Portugal	68.2	59.2	8.9	38.8
Russia	453.0	335.1	17.4	120.6
Spain	37.9	34.1	5.6	17.2
Sweden	21.2	19.1	2.4	14.9
Taiwan	71.6	61.1	11.1	51.3
United Kingdom	38.1	26.0	2.5	20.7
United States	37.8	28.4	3.7	21.0

Source: Authors' calculations based on data from WIOD.

Table 2

Total employment multipliers in construction are lower than at overall level

Country	1995	Avg 1996-2008	Difference	2009
Austria	21.2	19.6	-1.8	11.7
Belgium	11.8	11.7	-1.2	7.4
Canada	33.7	26.3	-1.1	17.6
Indonesia	391	448	-59	158
Latvia	170	81	-14	30.9
Mexico	164	98	-11	84.4
Poland	179	98	-16	40.1
Romania	279	218	-25	62.3
Slovenia	59.3	43.1	-4.6	24.8

Source: Authors' calculations based on data from WIOD.

The ***third group*** comprises eight countries of both HIC and MIC that registered a mix of the two previous situations, having a predominance of construction employment multipliers lower than the overall (next table). Among them, Bulgaria, Greece and Turkey showed occasionally higher multipliers in construction whereas China, India and Luxembourg recorded persistent lower multiplier effects in the construction sector after a period of higher sectoral multipliers. Conversely, Cyprus and Estonia presented higher sectoral employment multipliers during almost all of the last five-year period with data available.

The ***fourth and last group*** involves four countries: Brazil and Lithuania are MIC and Ireland and the Slovak Republic are HIC. Among them, it is interesting to note that Brazil and Ireland seem to have changed their previous relationship between construction employment multipliers and the overall multiplier effects because they were lower than the average at the beginning of the period but, later on, they became higher since 1999

Appendix 4
EMPLOYMENT IN THE CONSTRUCTION SECTOR VERSUS AT OVERALL LEVEL ACROSS TIME

and 2003, respectively. Lithuania and the Slovak Republic had a more erratic relationship between both multipliers in spite of the fact that the multiplier effect in most recent years was usually higher than the average.

Table 3
Total employment multipliers in construction are often lower than at overall level

Country	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Bulgaria	283	239	317	220	179	189	174	152	114	89,3	87,2	67,0	52,7	46,7	55,4
China	1408	1248	1136	1094	997	872	843	785	662	533	446	365	279	207	199
Cyprus	42,8	41,3	45,2	42,4	43,6	46,8	48,3	45,9	38,6	31,6	41,7	37,3	30,8	27,4	30,4
Estonia	137	111	112	92	104	97	77	73	57	48	44	38	33	32	36
Greece	45,6	42,2	42,7	44,5	44,4	46,7	43,2	45,9	35,6	30,8	31,4	26,9	25,3	25,3	28,4
India	2066	1879	1796	1734	1523	1499	1565	1443	1366	1143	1002	753	661	615	647
Luxembourg	10,7	10,6	11,4	12,2	12,1	13,2	13,5	12,0	8,8	7,3	6,8	5,7	4,7	3,3	4,2
Turkey	89,8	86,5	91,7	95,4	107,5	94,7	112,0	93,6	71,3	55,0	49,2	39,7	33,5	29,8	41,8

Source: Authors' calculations based on data from WIOD.

Table 4
Total employment multipliers in construction are often higher than at overall level

Country	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009
Brazil	182	165	154	160	233	232	274	306	300	249	202	171	166	142	162
Ireland	28,8	26,4	24,5	24,0	23,0	22,9	21,9	20,3	16,4	13,6	13,1	11,6	11,2	11,7	12,9
Lithuania	201	180	145	129	129	131	119	104	79	72	67	52	43	37	53
Slovak Republic	110	91	88	81	104	79	77	61	50	43	38	30	24	19	21

Source: Authors' calculations based on data from WIOD.

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Appendix 5

COMPARISON OF DATA SOURCES ACCORDING TO ACTIVITY BREAKDOWNS USED IN THE I-OTABLES

	Industry and Commodity breakdowns by dataset	
ISIC Rev. 3	**WIOD (35)**	**MRIO EORA (25)**
A	Agriculture, Hunting, Forestry and Fishing	Agriculture
B		Fishing
C	Mining and Quarrying	Mining and Quarrying
D.15t16	Food, Beverages and Tobacco	Food & Beverages
D.17t18	Textiles and Textile Products	Textiles and Wearing Apparel
D.19	Leather and Footwear	
D.20	Wood and Products of Wood and Cork	Wood and Paper
D.21t22	Pulp, Paper, Paper , Printing and Publishing	
D.23	Coke, Refined Petroleum and Nuclear Fuel	
D.24	Chemicals and Chemical Products	Petroleum, Chemical and Non-Metallic
D.25	Rubber and Plastics	Mineral Products
D.26	Other Non-Metallic Mineral	
D.27t28	Basic Metals and Fabricated Metal	Metal Products
D.29	Machinery, Nec	
D.30t33	Electrical and Optical Equipment	Electrical and Machinery
D.34t35	Transport Equipment	Transport Equipment
D.36	Manufacturing, Nec; Recycling	Other Manufacturing
D.37		Recycling
E	Electricity, Gas and Water Supply	Electricity, Gas and Water
F	Construction	Construction
G.50	Sale, Maintenance and Repair of Motor Vehicles and Motorcycles; Retail Sale of Fuel	Maintenance and Repair
G.51	Wholesale Trade and Commission Trade, Except of Motor Vehicles and Motorcycles	Wholesale Trade
G.52	Retail Trade, Except of Motor Vehicles and Motorcycles; Repair of Household Goods	Retail Trade Hotels and Restraurants
H	Hotels and Restaurants	
I.60	Inland Transport	
I.61	Water Transport	
I.62	Air Transport	Transport
I.63	Other Supporting and Auxiliary Transport Activities; Activities of Travel Agencies	
I.64	Post and Telecommunications	Post and Telecommunications
J	Financial Intermediation	Finacial Intermediation and Business Activities
K.70	Real Estate Activities	
K.71t74	Renting of M&Eq and Other Business Activities	
L	Public Admin and Defence; Compulsory Social Security	Public Administration
M	Education	Education, Health and Other Services
N	Health and Social Work	
O	Other Community, Social and Personal Services	
P	Private Households with Employed Persons	Private Households
Q	-	Others

Source: Authors' elaboration based on classifications from WIOD and EORA.